
NT8D14 Universal Trunk Card

Introduction

The NT8D14 Universal trunk Card is an Intelligent Peripheral Equipment (IPE) device that can be installed in either the NT8D37 IPE Module or the NT8D11 CE/PE Module. The Universal Trunk card interfaces eight analog trunk lines to the Meridian 1 switch. Each trunk interface is independently configurable by software control using the Trunk Administration program (LD 14).

The universal trunk card supports the following trunk types:

- Centralized Automatic Message Accounting (CAMA) trunks
- Central office (CO), Foreign Exchange (FX), and Wide Area Telephone Service (WATS) trunks
- Direct inward dial (DID) trunks
- Tie trunks: two-way loop dial repeating (LDR) and two-way loop outgoing automatic incoming dial (OAID)
- Recorded Announcement (RAN) trunks
- Paging trunks

The universal trunk card also supports Music, Automatic Wake Up, and Direct Inward System Access (DISA) features.

[Table 3](#) is a matrix of the signaling and trunk types supported by the universal trunk card.

Table 3
Trunk and signaling matrix

Signaling type	Trunk types					
	CO/FX/ WATS	DID	Tie	RAN	Paging	CAMA
Loop start	Yes	No (see note)	No	N/A	N/A	Yes
Ground start	Yes	No	No	N/A	N/A	No
Loop DR	No	Yes	Yes	N/A	N/A	No
Loop OAID	No	No	Yes	N/A	N/A	No
Continuous operation mode	No	No	No	Yes	N/A	No
Start modes (pulse and level)	No	No	No	Yes	N/A	No
Note: For incoming and outgoing service, DID trunks must be programmed as loop dial repeating.						

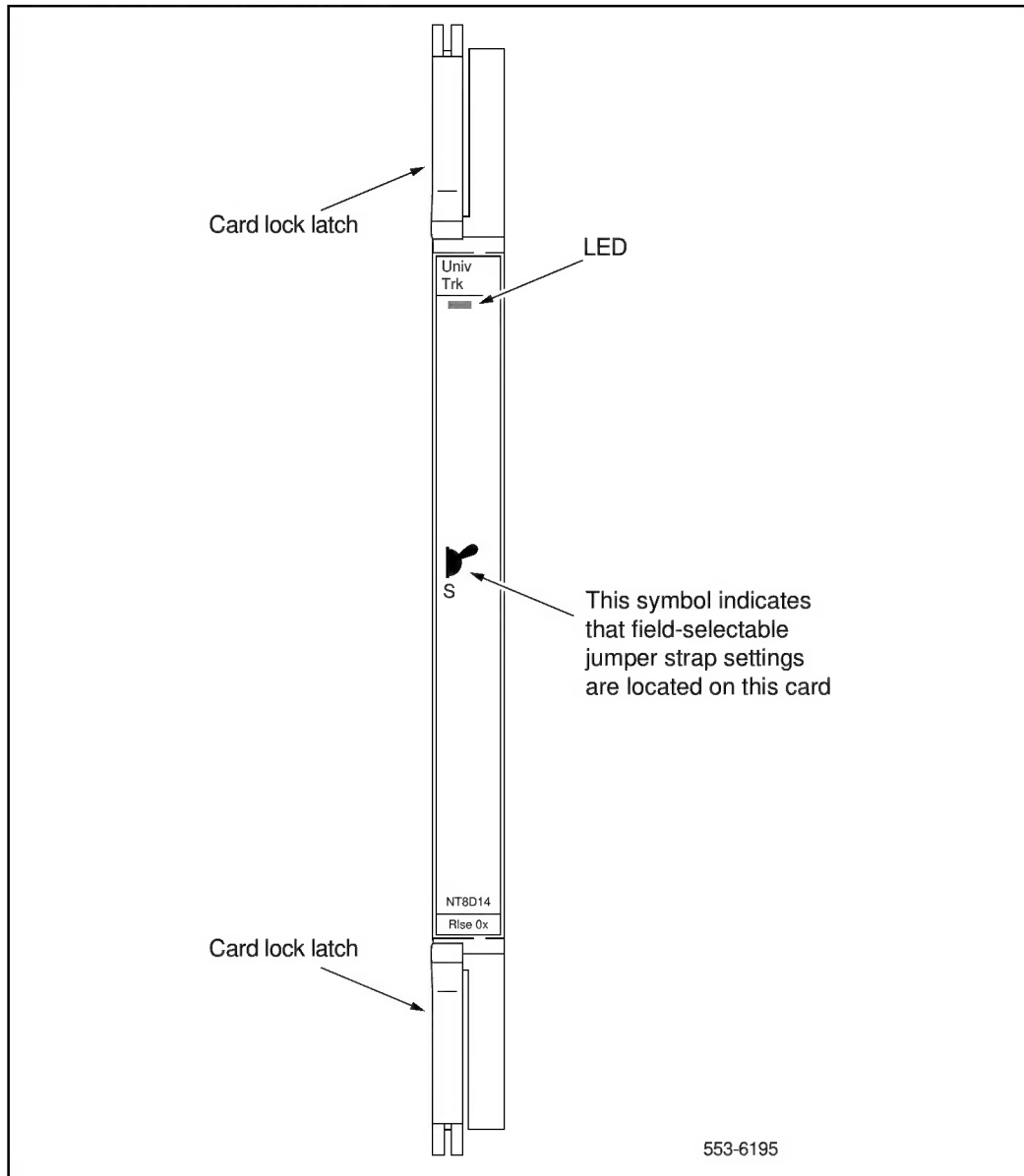
Physical description

The universal trunk card mounts in any IPE slot. The trunk and common multiplexing circuitry is mounted on a 31.75 cm by 25.40 cm (12.5 in. by 10 in.) printed circuit board.

The universal trunk card connects to the backplane through a 160-pin connector shroud. The backplane is cabled to the input/output (I/O) panel, which is cabled to the main distribution frame (MDF) by 25-pair cables. External equipment, such as recorded announcement machines, paging equipment, and central office facilities, connect to the card at the MDF. See *Meridian 1 system installation procedures* (553-3001-210) for termination and cross-connect information.

The faceplate of the card is equipped with a red light emitting diode (LED) (see [Figure 11](#)). When a universal trunk card is installed, the LED remains lit for 2 to 5 seconds while the self-test runs. If the self-test completes successfully, the LED flashes three times and remains lit until the card is configured and enabled in software, then the LED goes out. If the LED does not follow this pattern or operates in any other manner, such as continually flashing or remaining weakly lit, the card should be replaced.

Figure 11
Universal trunk card—faceplate



Card interfaces

The universal trunk card passes voice and signaling data over DS-30X loops, and maintenance data over the card LAN link. These interfaces are discussed in detail in “Intelligent peripheral equipment” on page 15.

Trunk interface units

The universal trunk card contains eight identical and independently configurable trunk interface units (also referred to as circuits). Each unit provides impedance matching and a balance network in a signal transformer/analog hybrid circuit. Also provided are relays for placing outgoing call signaling onto the trunk. Signal detection circuits monitor incoming call signaling. Two codecs are provided for performing A/D and D/A conversion of trunk analog voiceband signals to digital PCM signals. Each codec supports four trunk interface units. The following features are common to all units on the card:

- trunk type configurable on a per unit basis
- terminating impedance (600 or 900 ohm) selectable on a per unit basis (minimum vintage BA)
- balance impedance (600 or 900 ohm or complex impedance network) selectable on a per unit basis (minimum vintage BA)
- control signals provided for RAN and paging equipment
- loopback of PCM signals received from trunk facility over DS-30X network loop for diagnostic purposes
- switchable pads for transmission loss control

Card control functions

Control functions are provided by a microcontroller, a card LAN interface, and signaling and control circuits on the universal trunk card.

Microcontroller

The universal trunk card contains a microcontroller that controls the internal operation of the card and the serial card LAN link to the controller card. The microcontroller controls the following:

- reporting to the CE CPU via the card LAN link:
 - card identification (card type, vintage, and serial number)
 - firmware version
 - self-test status
 - programmed configuration status
- receipt and implementation of card configuration via the card LAN link:
 - programming of the codecs
 - enabling/disabling of individual units or entire card
 - programming of input/output interface control circuits for administration of trunk interface unit operation
 - maintenance diagnostics
 - transmission pad settings

Card LAN interface

Maintenance data is exchanged with the common equipment CPU over a dedicated asynchronous serial network called the Card LAN link. The card LAN link is described in “Intelligent peripheral equipment” on page 15.

Signaling and control

The signaling and control portion of the card provides circuits that establish, supervise, and take down call connections. These circuits work with the system CPU to operate trunk interface circuits during calls. The circuits receive outgoing call signaling messages from the CPU and return incoming call status information over the DS-30X network loop.

Operation

The optional applications, features, and signaling arrangements for each unit on the universal trunk card are assigned through the Trunk Administration (LD 14) and Trunk Route Administration (LD 16) programs and/or jumper strap settings on the card. See the *X11 input/output guide* for detailed information on assigning features and services to trunks.

Loop start operation

Loop start operation is configured in software and is implemented in the card through software download messages. When the universal trunk card is idle, it provides a high impedance toward the CO for isolation and AC (ringing) detection.

Incoming calls

The alerting signal into the Meridian 1 is 20 Hz (nominal) ringing sent by the CO. When an incoming call is answered, ringing is tripped when the Meridian 1 places a low-resistance DC loop across the tip and ring leads toward the CO (see [Figures 13](#) and [14](#)).

Outgoing calls

For outgoing calls from the Meridian 1, software sends an outgoing seizure message to place a low-resistance loop across the tip and ring leads toward the CO (see [Figures 15](#) and [16](#)). When the CO detects the low-resistance loop, it prepares to receive digits. When the CO is ready to receive digits, it returns dial tone. Outward address signaling is then applied from the Meridian 1 in the form of loop (interrupting) dial pulses or DTMF tones.

Polarity-sensitive/-insensitive packs feature The Meridian 1 software provides the polarity-sensitive/-insensitive packs (PSP and PIP) feature for the accurate recording of outgoing call duration for loop start and ground start operation. On trunks equipped with far-end answer supervision, the PSP class of service is enabled in software and causes call-duration recording in CDR records to begin only upon receipt of answer supervision from the far end. For trunks not equipped with answer supervision, the PIP class of service is enabled and call-duration recording begins immediately upon near-end trunk seizure. The PSP and PIP classes of service are enabled in the Trunk Administration program (LD 14).

Figure 13
Loop start call states—incoming call from CO/FX/WATS

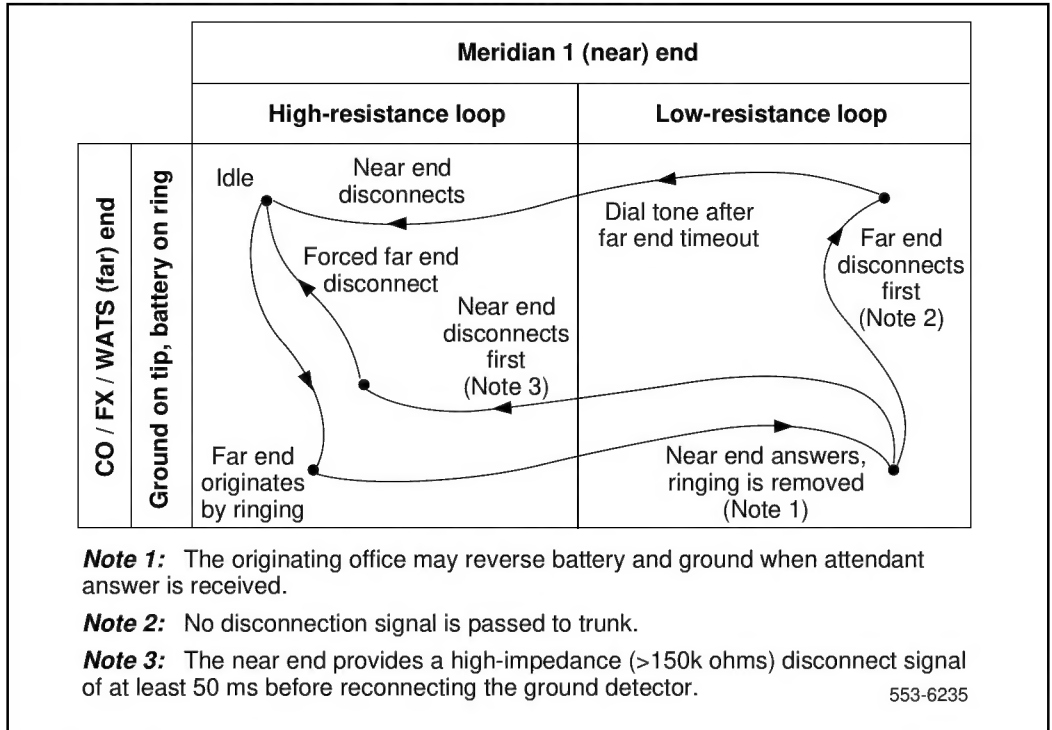


Figure 14
Loop start call connection sequence—incoming call from CO/FX/WATS

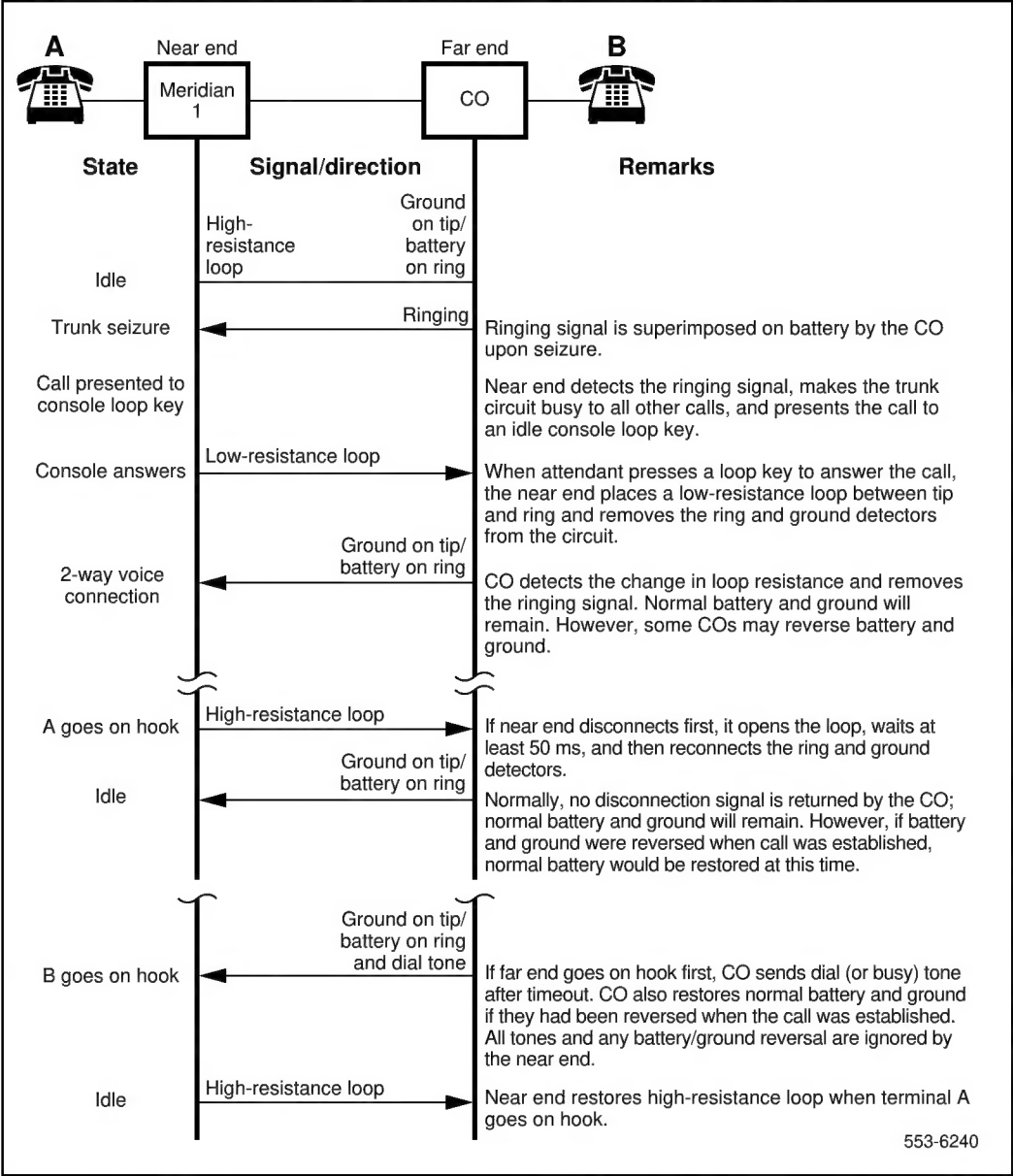


Figure 15
Loop start call states—outgoing call to CO/FX/WATS

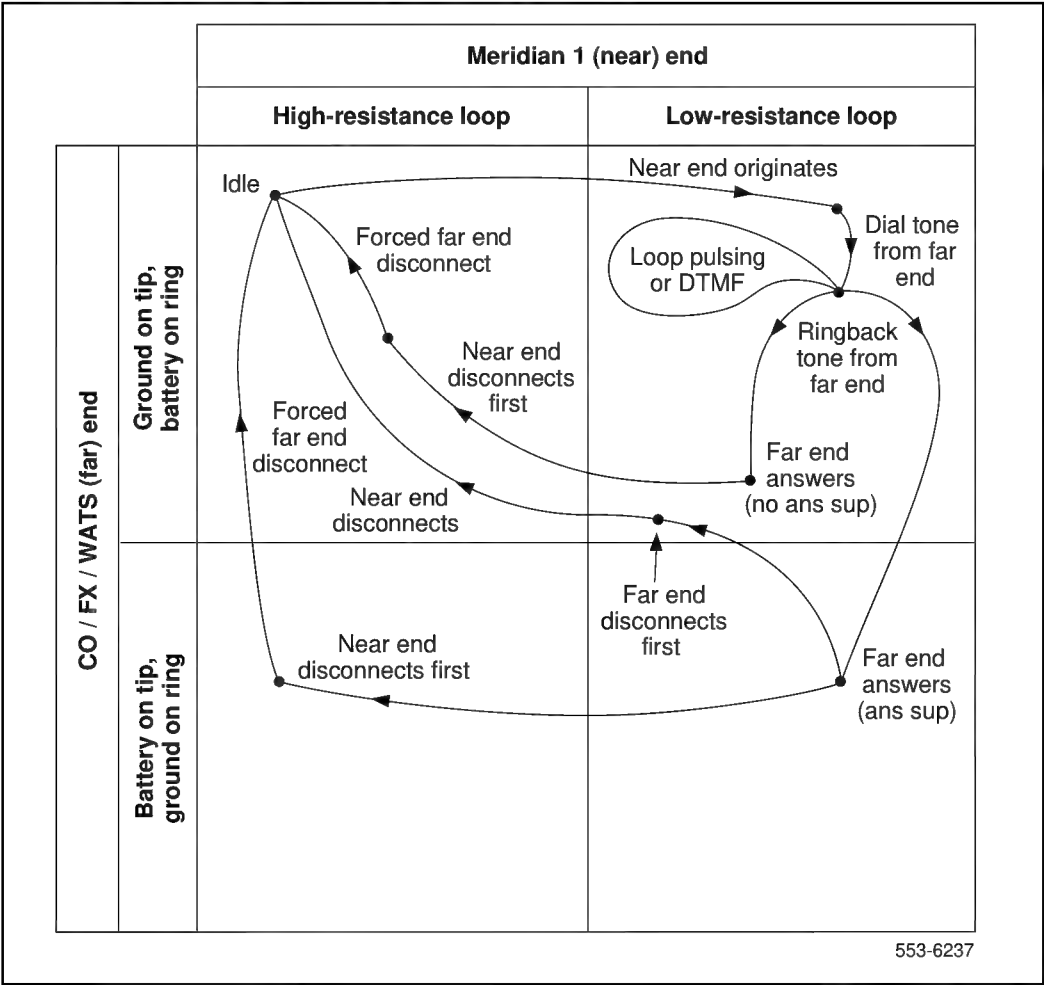
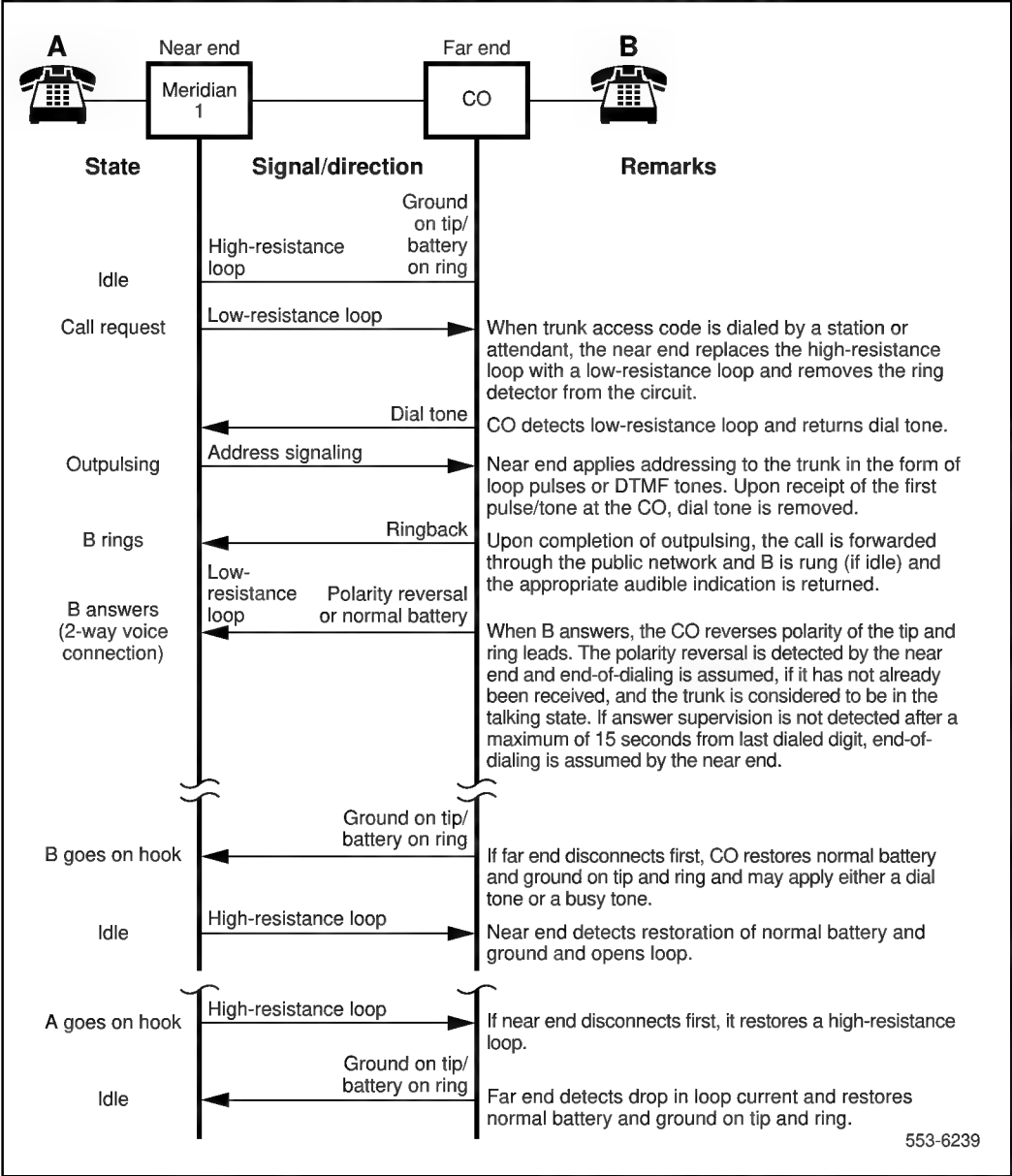


Figure 16
Loop start call connection sequence—outgoing call to CO/FX/WATS



Ground start operation

Ground start operation is configured in software and implemented through software download messages. In the idle state, the tip conductor from the CO is open and a high-resistance negative battery is present on the ring lead.

Incoming calls

In an incoming call, after ground is detected on the tip, the universal trunk card scans for a ringing detection signal before presenting the call to an attendant and tripping the ringing. When the attendant answers, a low resistance is placed across the tip and ring conductors, which trips CO ringing and establishes a speech path (see [Figures 17](#) and [18](#)).

Reverse-wiring compensation The Meridian 1 software includes a feature for detecting reverse wiring (connection of near-end tip and ring leads to far-end ring and tip leads, respectively) on ground start trunks with far-end answer supervision.

Ordinarily, an incoming call on a reverse-wired trunk without reverse-wiring compensation will present ringing on the tip lead rather than on the ring lead. Since software expects to see a ground on the tip lead, it will interpret the end of the first ringing signal as a switchhook flash. But since the interval between ringing signals exceeds the switchhook flash time of 512 milliseconds, software assumes far-end disconnect. This causes the call to be presented to a console loop key and then immediately removed.

The reverse-wiring compensation feature operates as follows. If an apparent disconnect takes place immediately after the first ringing signal, the software will time stamp the event and temporarily remove the call from the console loop key. If another such ringing/disconnect event occurs during the no ringing detector (NRD) time, the trunk will be considered “*possibly* reverse wired” and a threshold counter will be incremented. Calls on trunks identified as possibly reverse wired will be presented to the attendant during the initial ring, removed, and then continuously presented after the second ring. If a call on a possibly reverse-wired trunk is abandoned before the attendant answers, it will be disconnected after the NRD timer expires.

Figure 17
Ground start call states—incoming call from CO/FX/WATS

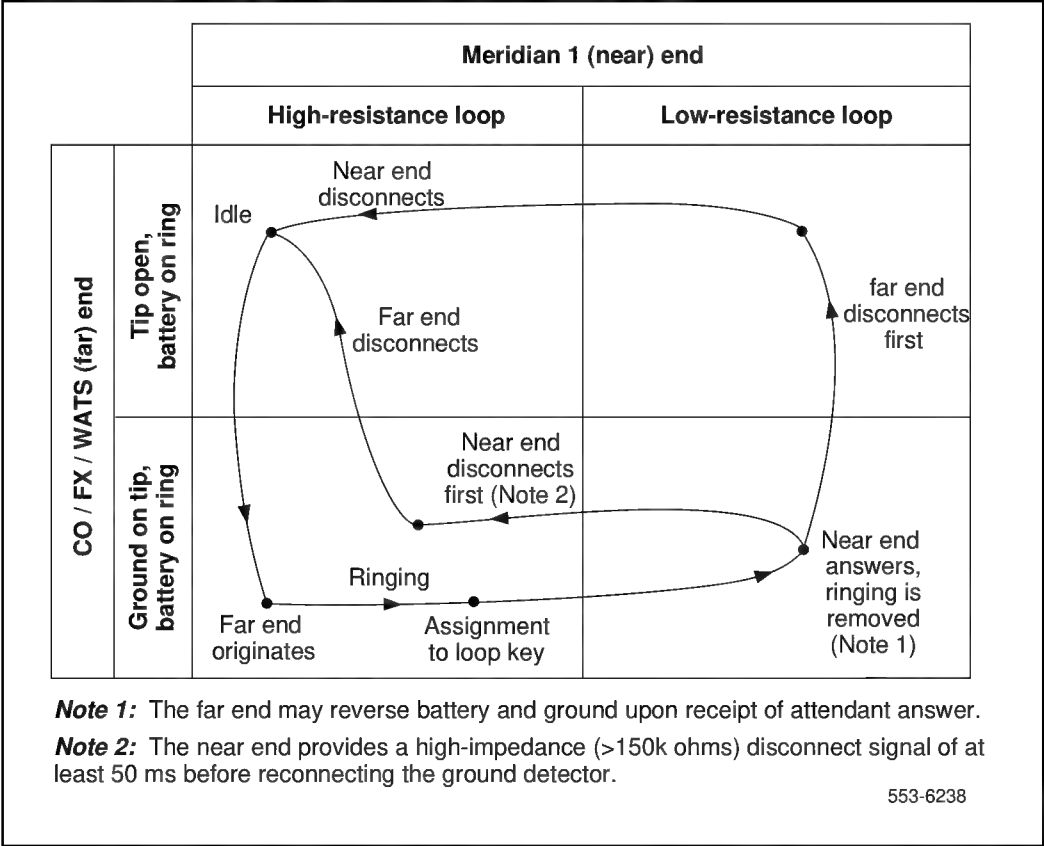
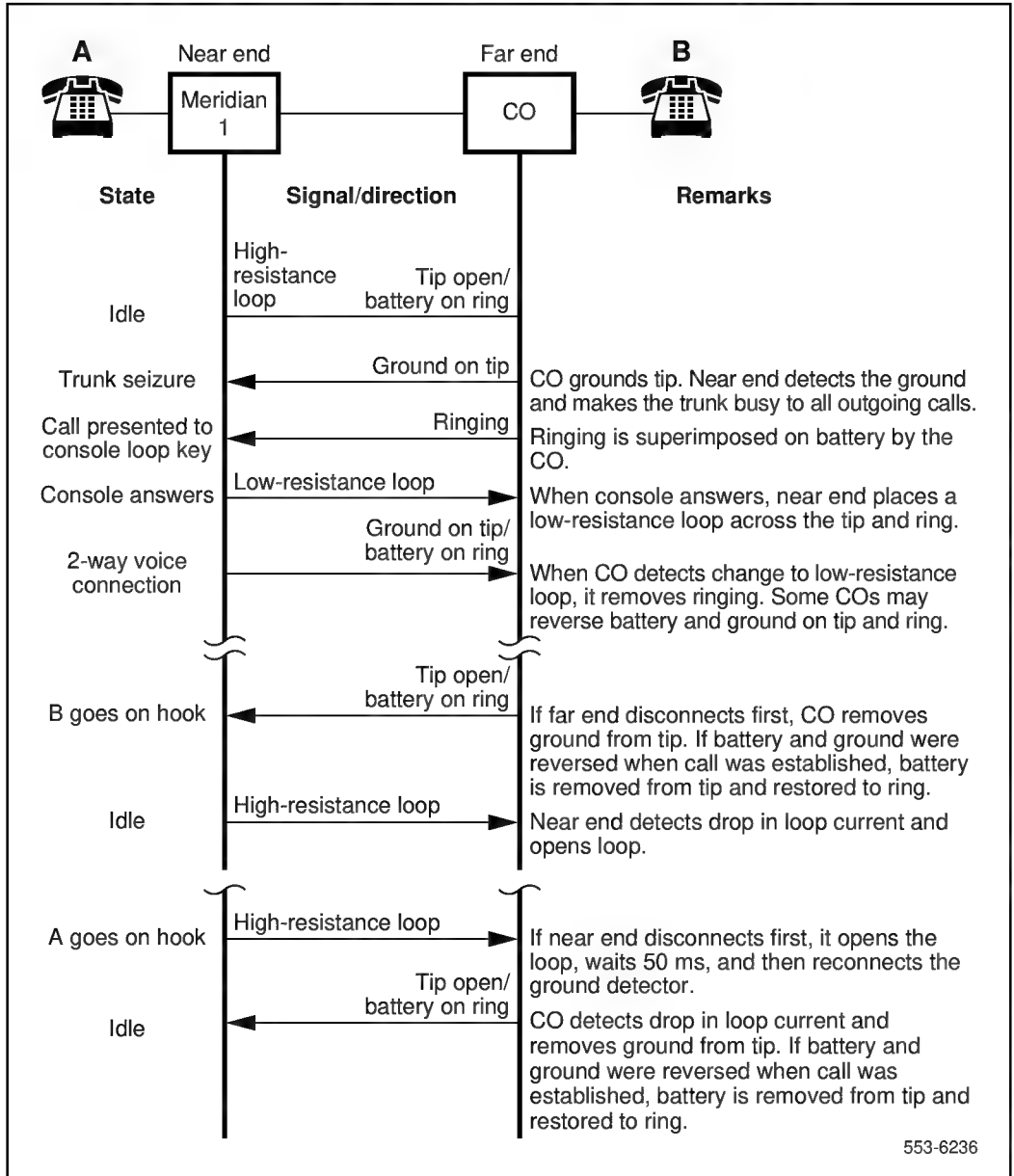


Figure 18
Ground start call connection sequence—Incoming call from CO/FX/WATS



Trunks identified as possibly reverse wired will be switched by software to loop start processing after the second ring. This switching takes place on a call-by-call basis. Thus, if a previously correctly wired trunk becomes reverse wired, the next incoming call will be marked as possibly reverse wired and the threshold count will begin.

If the threshold count exceeds its limit, an error message is printed and the trunk is registered as “*positively* reverse wired.” Once identified as positively reverse wired, the call will be presented continuously from the first ring. When a reverse-wired trunk becomes correctly wired, the first subsequent call will clear the threshold counter and normal ground start processing will be implemented.

Outgoing calls

For outgoing calls, the trunk provides ground to the ring lead. The CO responds by grounding the tip and returning dial tone. After the tip ground is detected by the card, a low-resistance path is placed between the tip and ring leads and the ground is removed from the ring. Addressing is then applied from the Meridian 1 in the form of loop (interrupting) dial pulses or DTMF tones (see [Figures 19](#) and [20](#)).

The polarity-sensitive/-insensitive packs (PSP and PIP) feature must be set to provide for proper outgoing call-duration recording with ground start operation. Refer to the description of loop start operation in this section for a more complete discussion of PSP and PIP.

Figure 19
Ground start call states—outgoing call to CO/FX/WATS

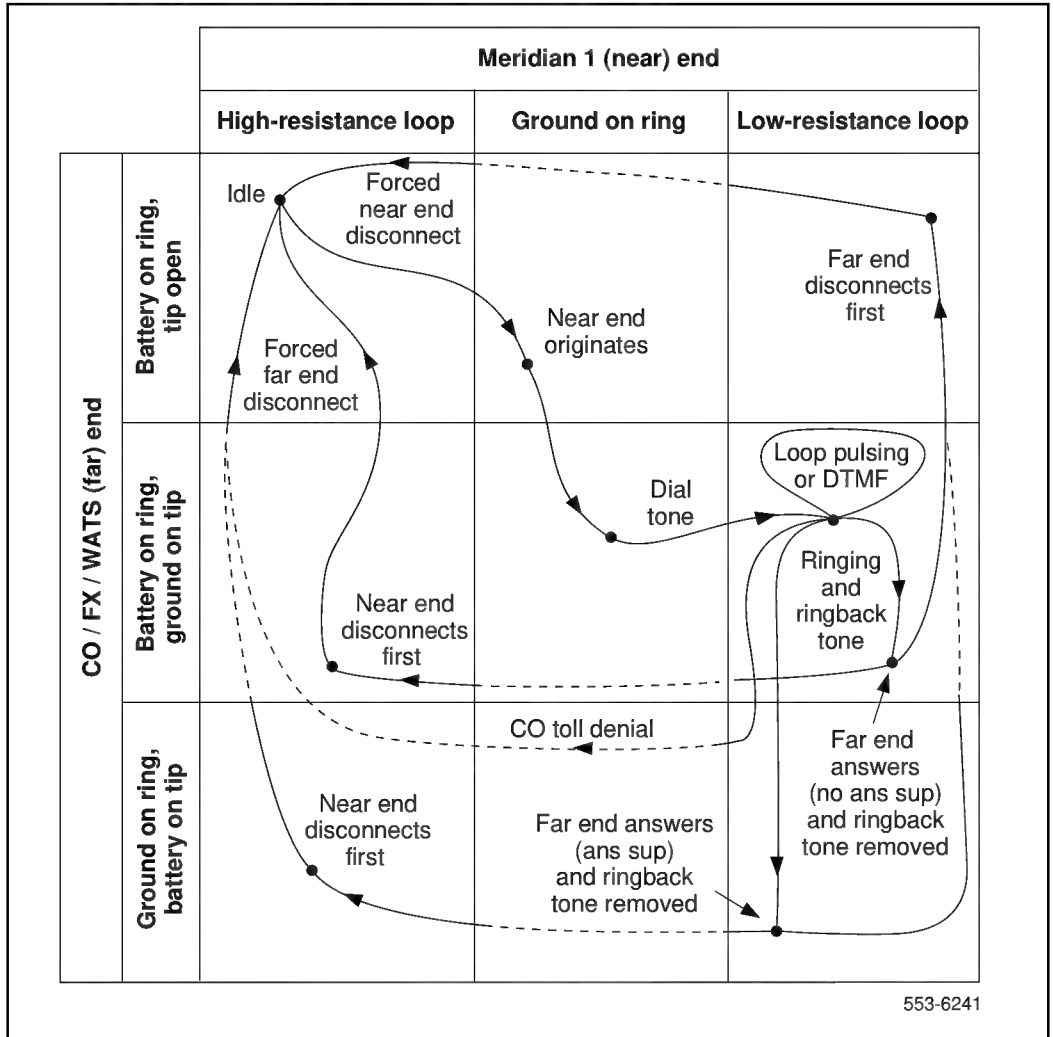
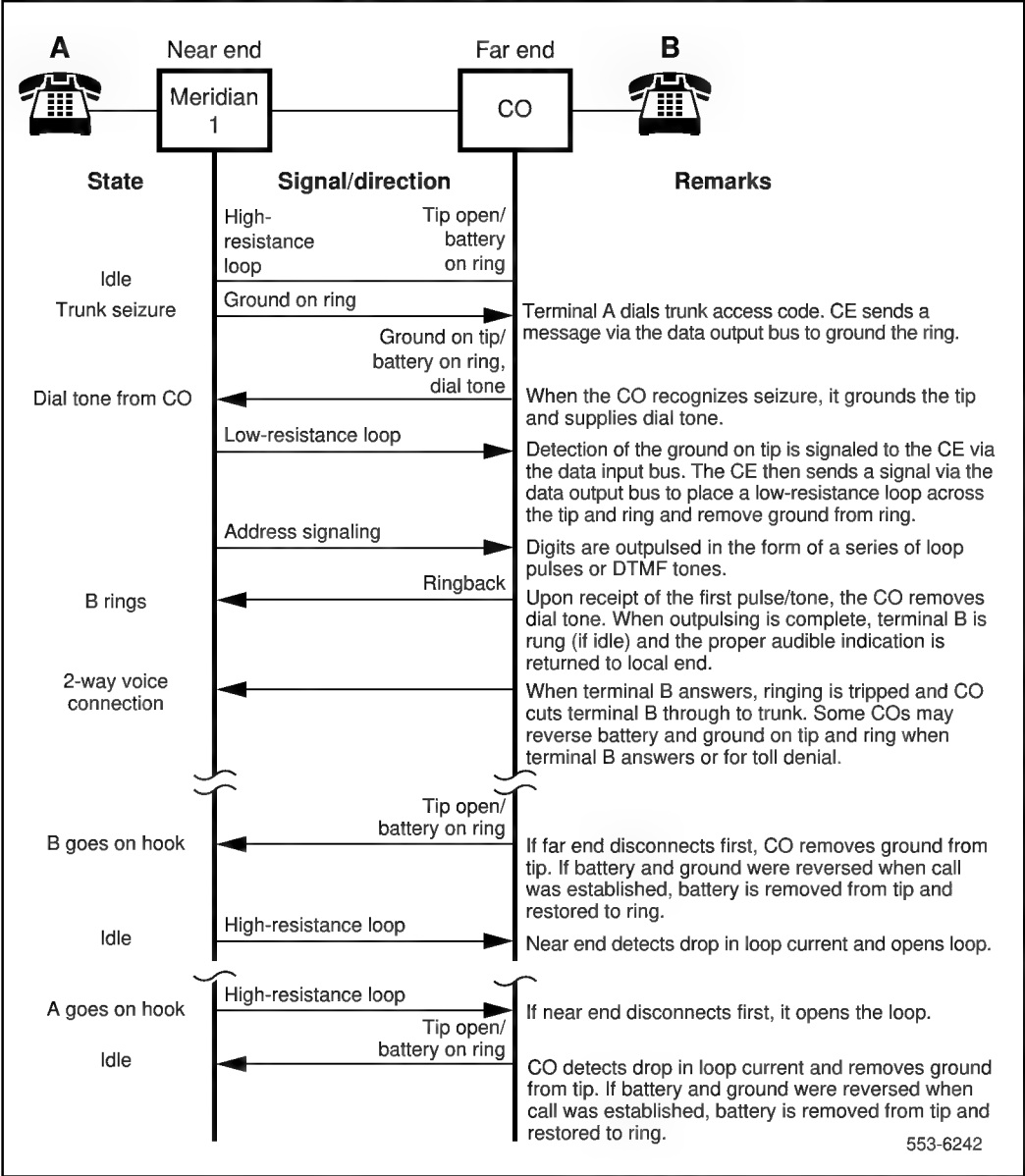


Figure 20
Ground start call connection sequence—outgoing call to CO/FX/WATS



Direct inward dial operation

Incoming calls

An incoming call from the CO places a low-resistance loop across the tip and ring leads (see [Figures 21](#) and [22](#)). Dial pulses or DTMF tones are then presented from the CO. When the called party answers, the universal trunk card reverses battery and ground on the tip and ring leads to the CO. The trunk is arranged for first party release. The CO releases the trunk by removing the low-resistance loop, at which time normal battery and ground are restored at the near end. The operation represented in [Figures 21](#) and [22](#) also applies to incoming tie trunk calls from a far-end PBX.

Two-way, loop dial repeating, tie trunk operation

Incoming calls

In an incoming call configuration, the far end initiates a call by placing a low-resistance loop across the tip and ring leads (see [Figures 23](#) and [24](#)). This causes a current to flow through the battery feed resistors in the trunk circuit. Address signaling is then applied by the far end in the form of DTMF tones or dial pulses. When the called party answers, an answer supervision signal is sent by software, causing the Meridian 1 to reverse battery and ground on tip and ring to the far end. Far-end disconnect is initiated by opening the loop while near-end disconnect is initiated by restoring normal battery and ground. The operation represented in [Figures 23](#) and [24](#) also applies to incoming DID trunk calls from a CO.

Outgoing calls

In an outgoing call configuration, the universal trunk card is connected to another PBX by a tie trunk (see [Figures 25](#) and [26](#)). An outgoing call from the near end seizes the trunk facility by placing a low-resistance loop across the tip and ring leads. Outward addressing is then applied from the Meridian 1 in the form of DTMF tones or dial pulses. If answer supervision is provided by the far end, reverse battery and ground on tip and ring is returned. The operation represented in [Figures 25](#) and [26](#) also applies to outgoing calls on a DID trunk.

Figure 21
DID trunk, loop DR call states—Incoming call from CO

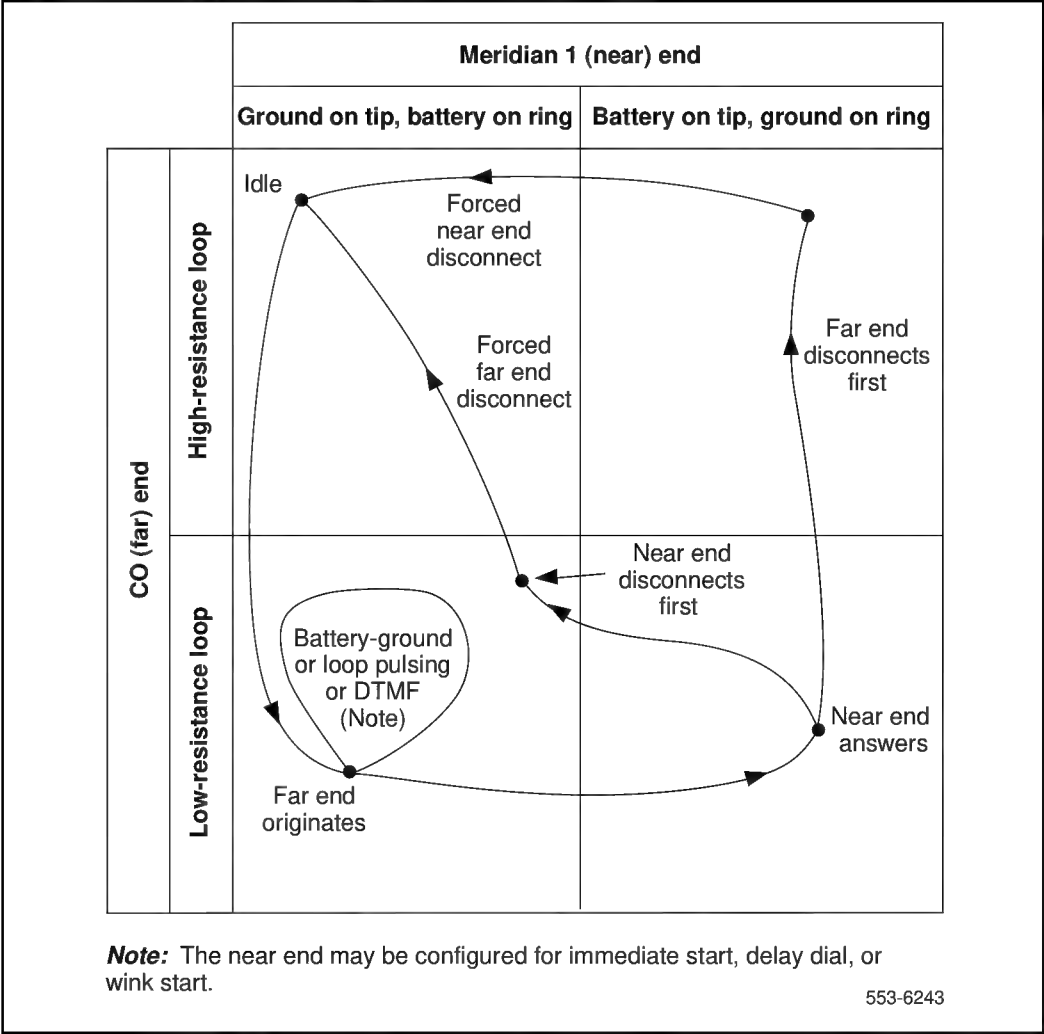


Figure 22
DID trunk, loop DR call connection sequence—incoming call from CO

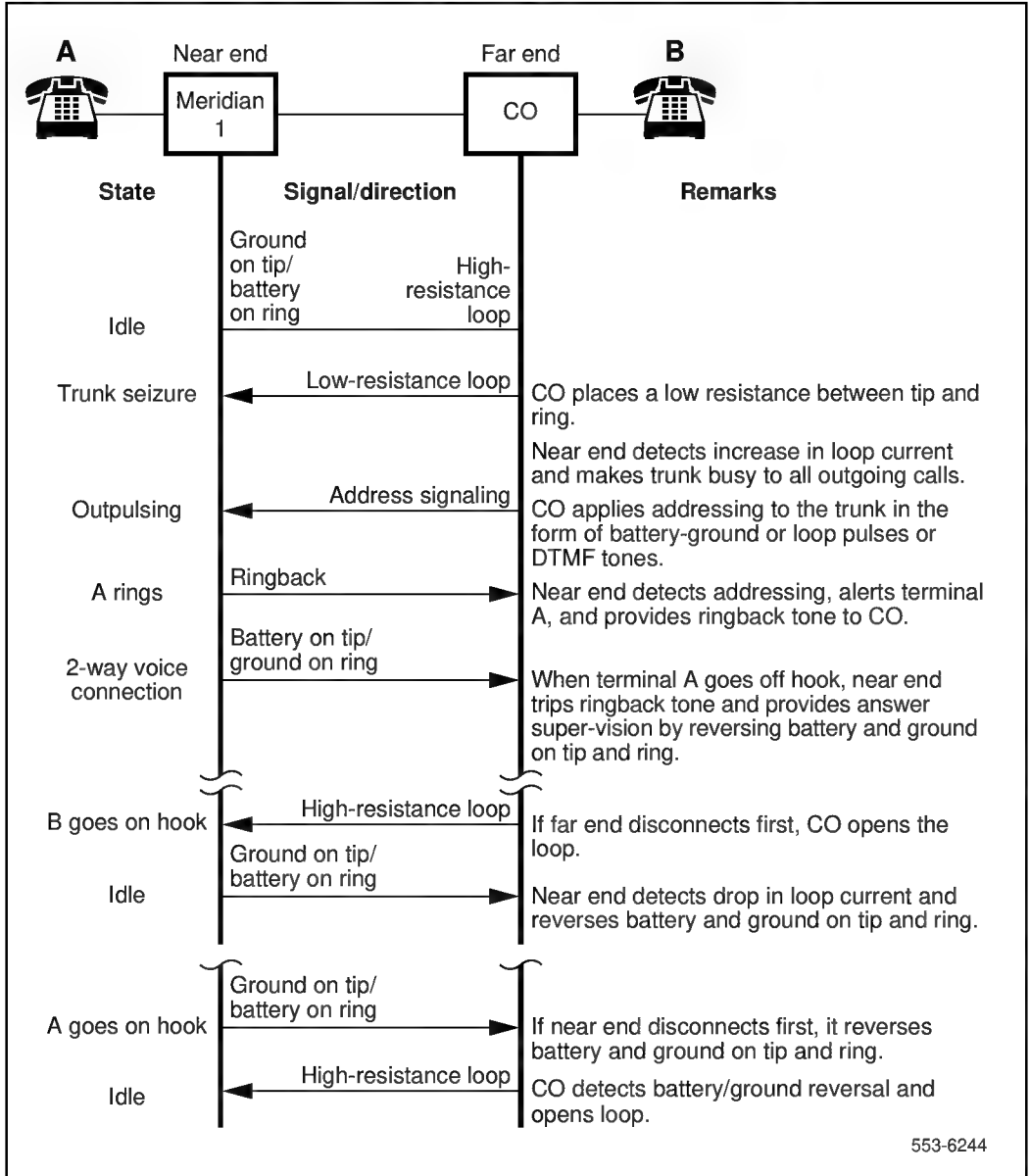


Figure 23
Two-way, loop DR, tie trunk call states—incoming call from far-end PBX

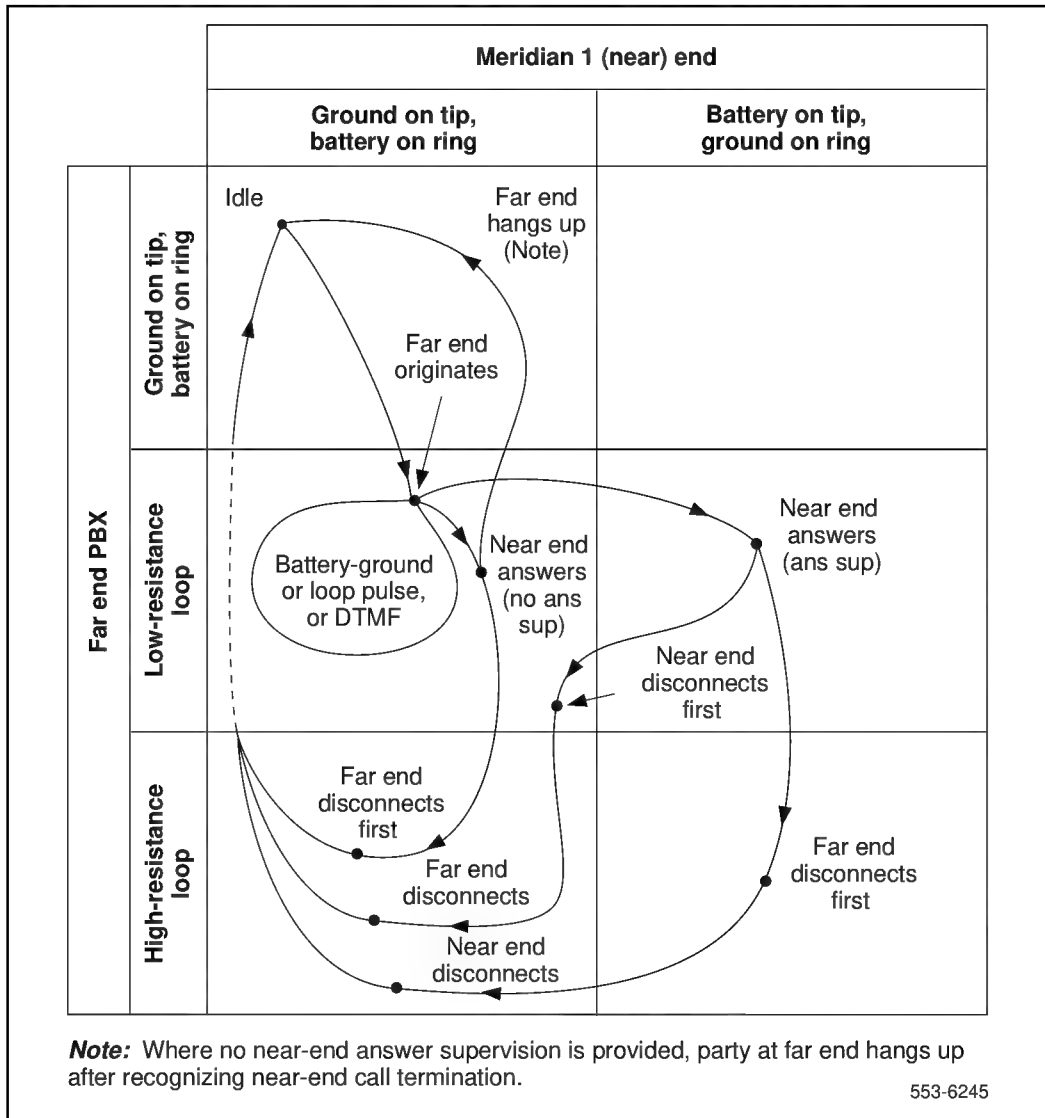


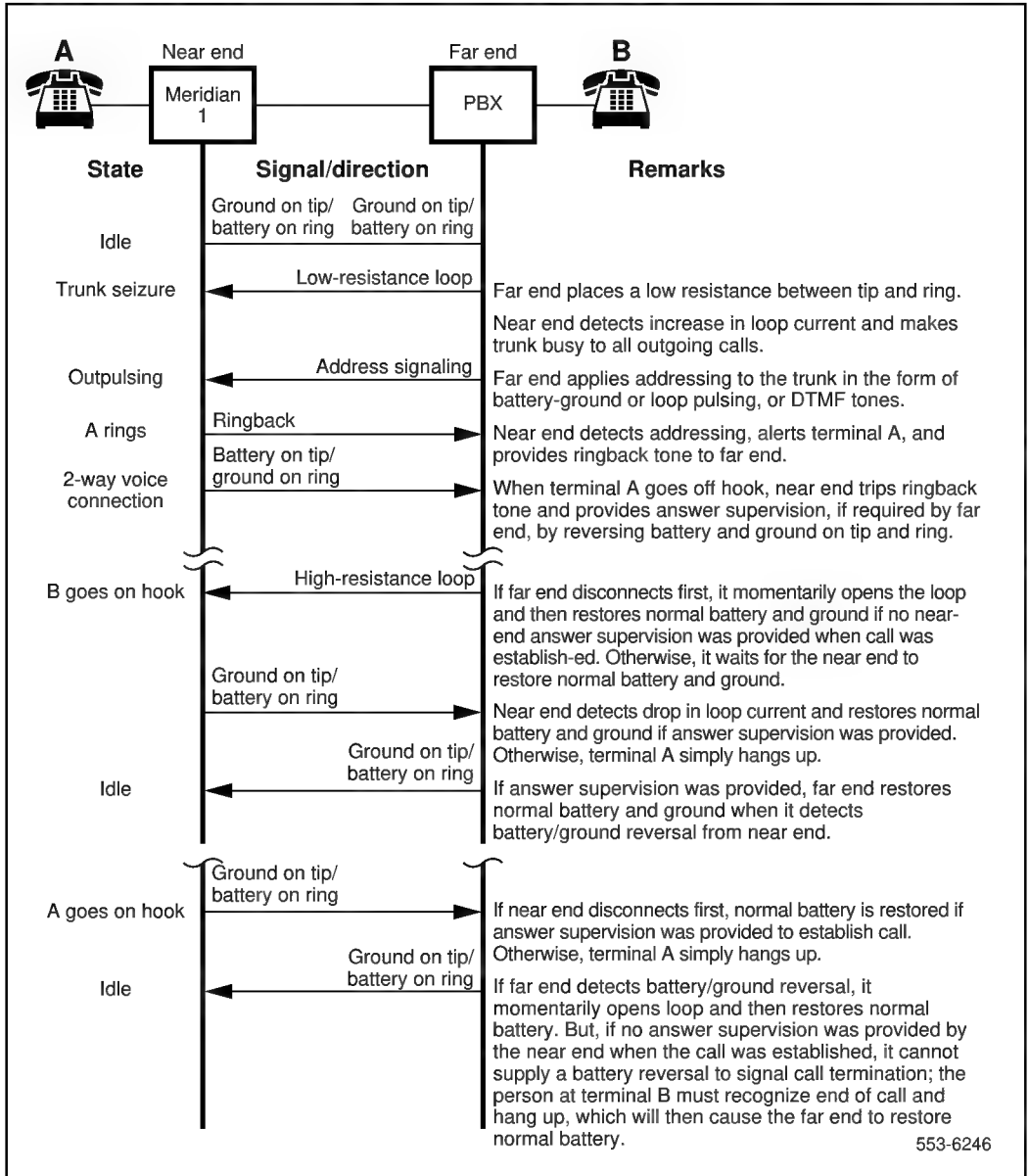
Figure 24**Two-way, loop DR, tie trunk call connection sequence—Incoming call from far-end PBX**

Figure 25
Two-way, loop DR, tie trunk call states—outgoing call to far-end PBX

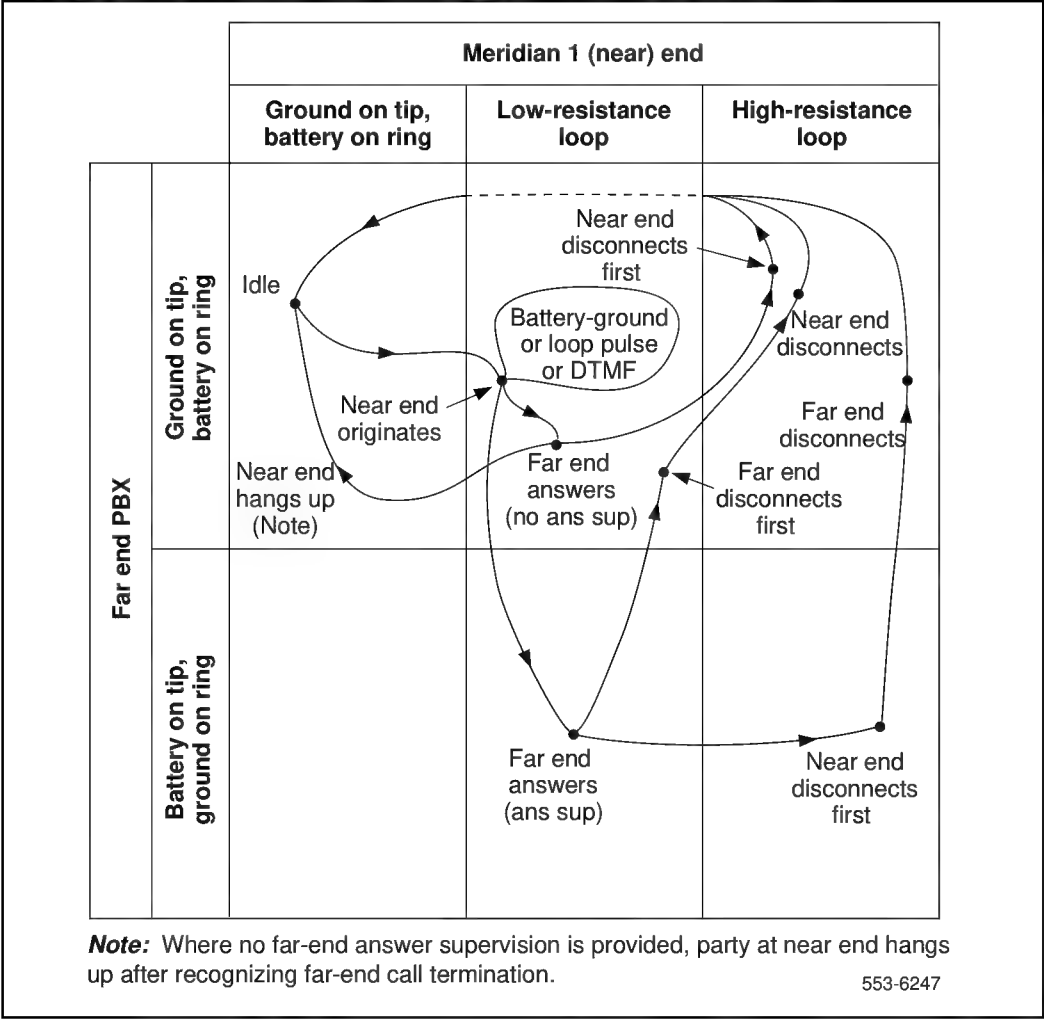
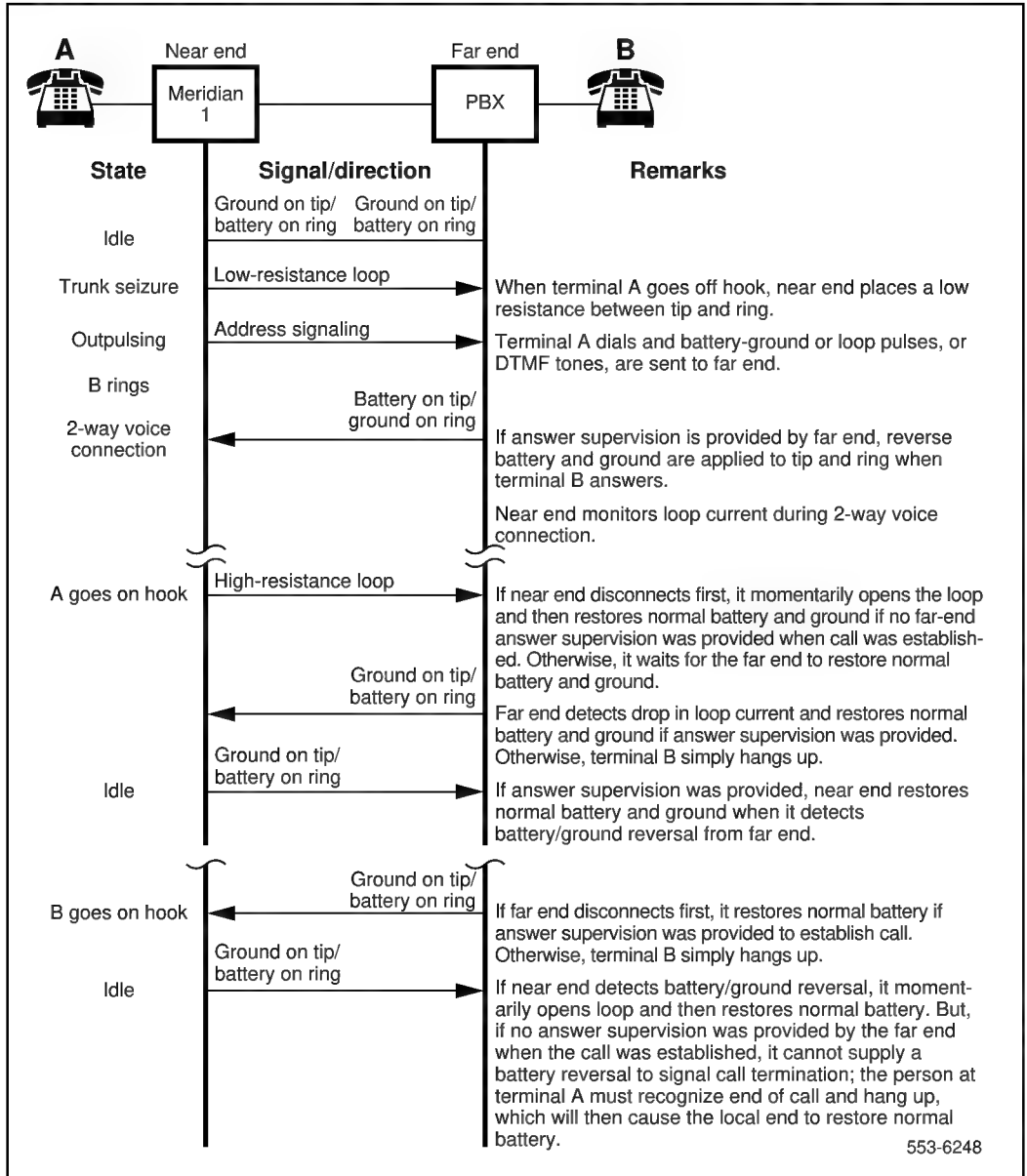


Figure 26
Two-way, loop DR, tie trunk call connection sequence—outgoing call to far-end PBX


Senderized operation for DID and two-way loop DR trunks

Incoming calls

If the far end is senderized, the near end can be operated in any mode: immediate start (IMM), delay dial (DDL) or wink (WNK) start, as assigned at the STRI prompt in the Trunk Administration program (LD 14) (see [Figure 27](#)).

For immediate start, following the seizure signal, the far end may start pulsing after the standard delay (normally 65 ms, minimum).

For delay dial or wink start modes, stop/go signaling (off hook/on hook or battery/ground reversal) is returned by the Meridian 1 after receipt of the seizure signal. The delay dial (stop) signal begins immediately upon seizure and ends (go signal) 384 ms later. The wink start (stop) signal begins 384 ms after seizure and ends (go signal) 256 ms later. The far end detecting the go signal may start pulsing after the standard delay (normally 55 ms, minimum). Stop/go signaling, in addition to the signaling function, serves as an integrity check to help identify a malfunctioning trunk.

If required, the near end can be configured to provide pseudo-answer supervision at expiration of the end-of-dial timer. End-of-dial timer settings are made at the EOD (non-DTMF) or ODT (DTMF) prompts in the Trunk Route Administration program (LD 16).

The operation represented in [Figure 27](#) also applies to incoming calls on a DID trunk from a CO.

Outgoing calls

When DDL or WNK mode is used, outgoing calls require a stop/go signal from the far end so that the near end cannot outpulse until the far end is ready to receive digits (see [Figure 28](#)).

Figure 27

Two-way, loop DR, tie trunk call states—incoming call through senderized, tandem PBX from a CO/FX/WATS trunk

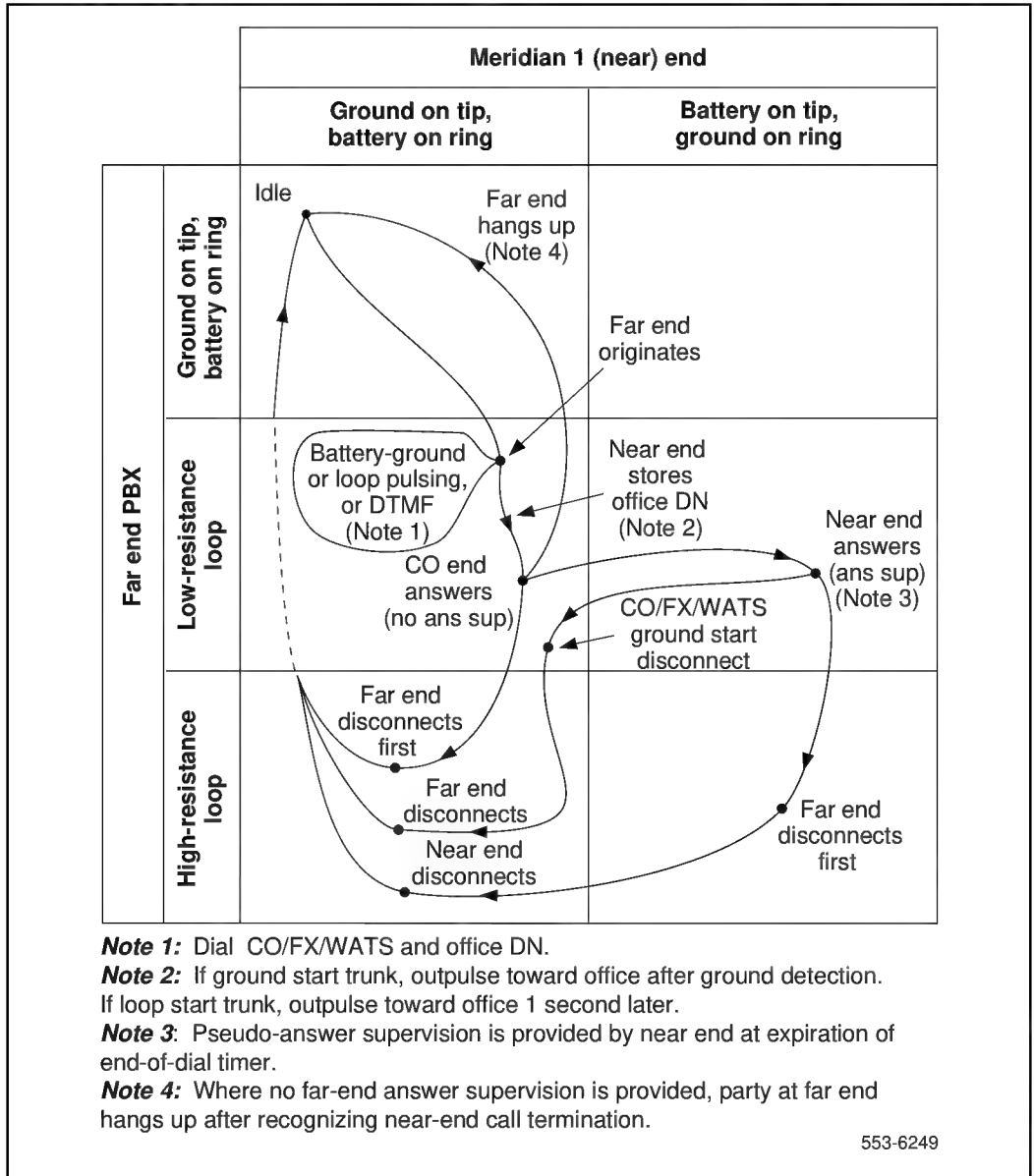
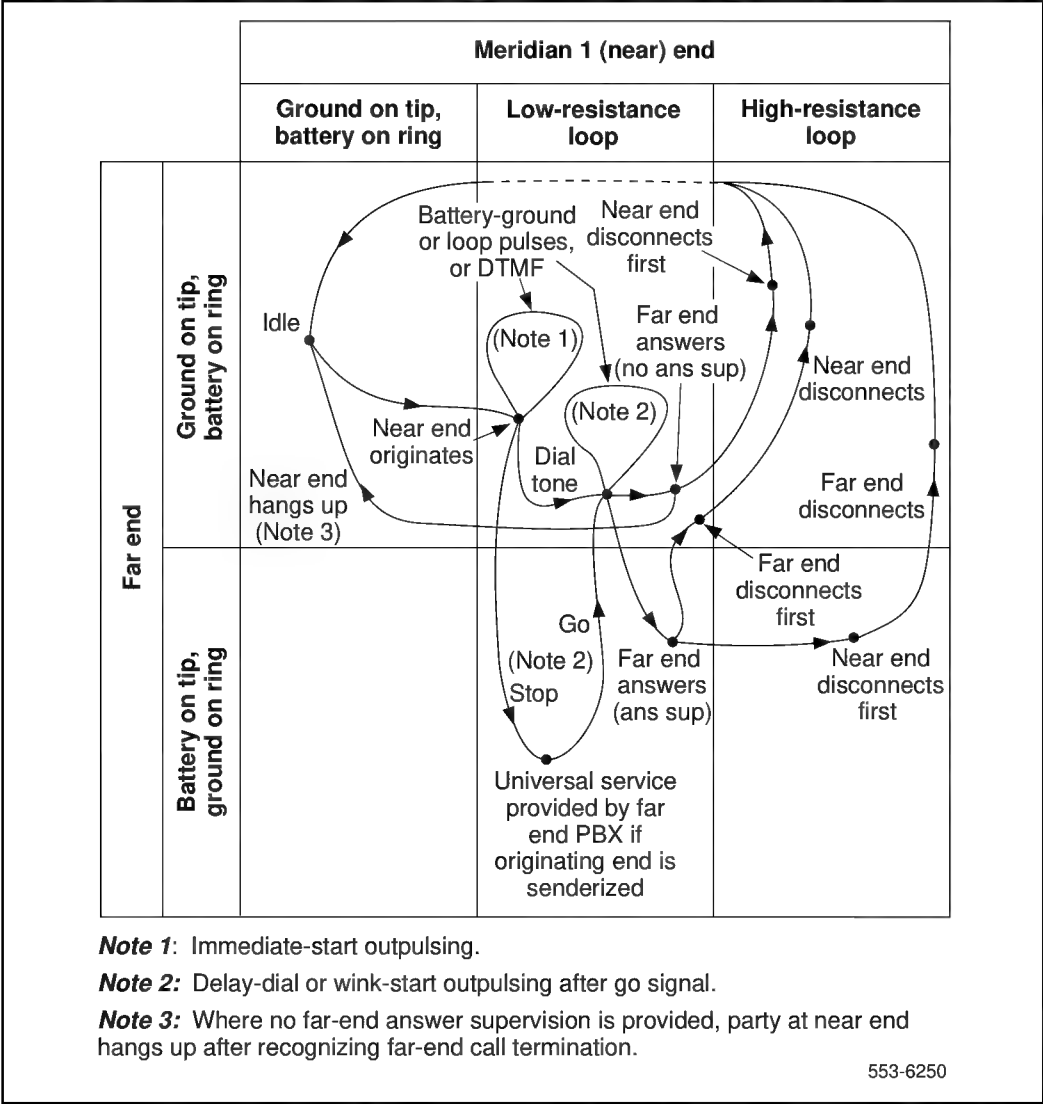


Figure 28
Two-way, loop DR, tie trunk call states—outgoing call through far-end PBX to CO/FX/WATS



Outgoing automatic, incoming dial operation

Incoming calls

When the universal trunk card is seized by the far end on an incoming call, a low-resistance loop is placed across the tip and ring leads. Addressing is then sent by the far end in the form of battery-ground or loop pulses, or DTMF tones. The trunk is released at the far end when the loop is opened. When the near end detects an open loop, it returns to a normal state. See [Figures 29](#) and [30](#).

Outgoing calls

When seized as a dial-selected outgoing trunk, the near end places battery on the tip and ground on the ring. This alerts the far end of the seizure. The far end responds with a low resistance across the tip and ring leads. See [Figures 31](#) and [32](#).

Figure 29
Two-way, loop OAID, tie trunk call states—Incoming call from far-end PBX

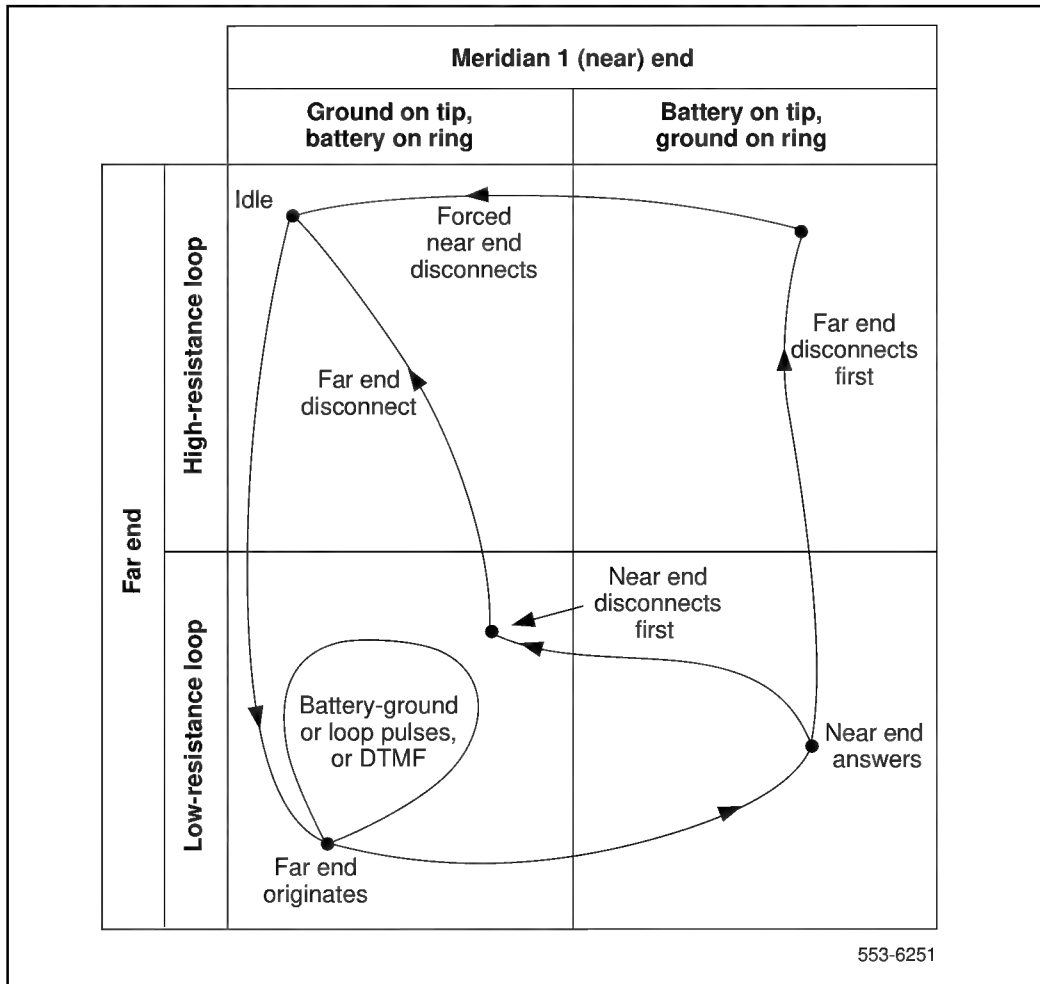


Figure 30

Two-way, loop OAID, tie trunk call connection sequence—Incoming call from far-end PBX

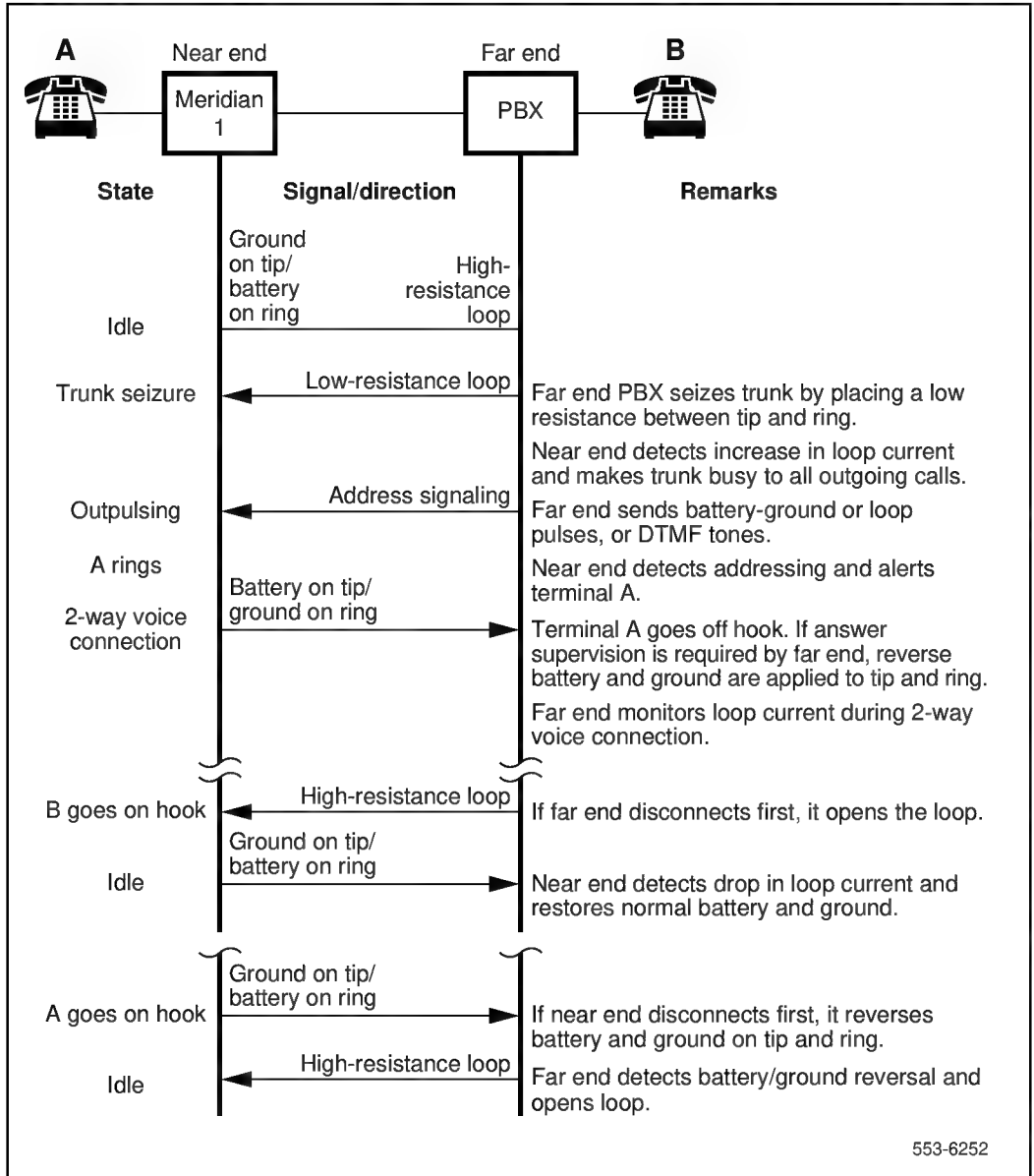


Figure 31
Two-way, loop OAID, tie trunk call states—outgoing call to far-end PBX

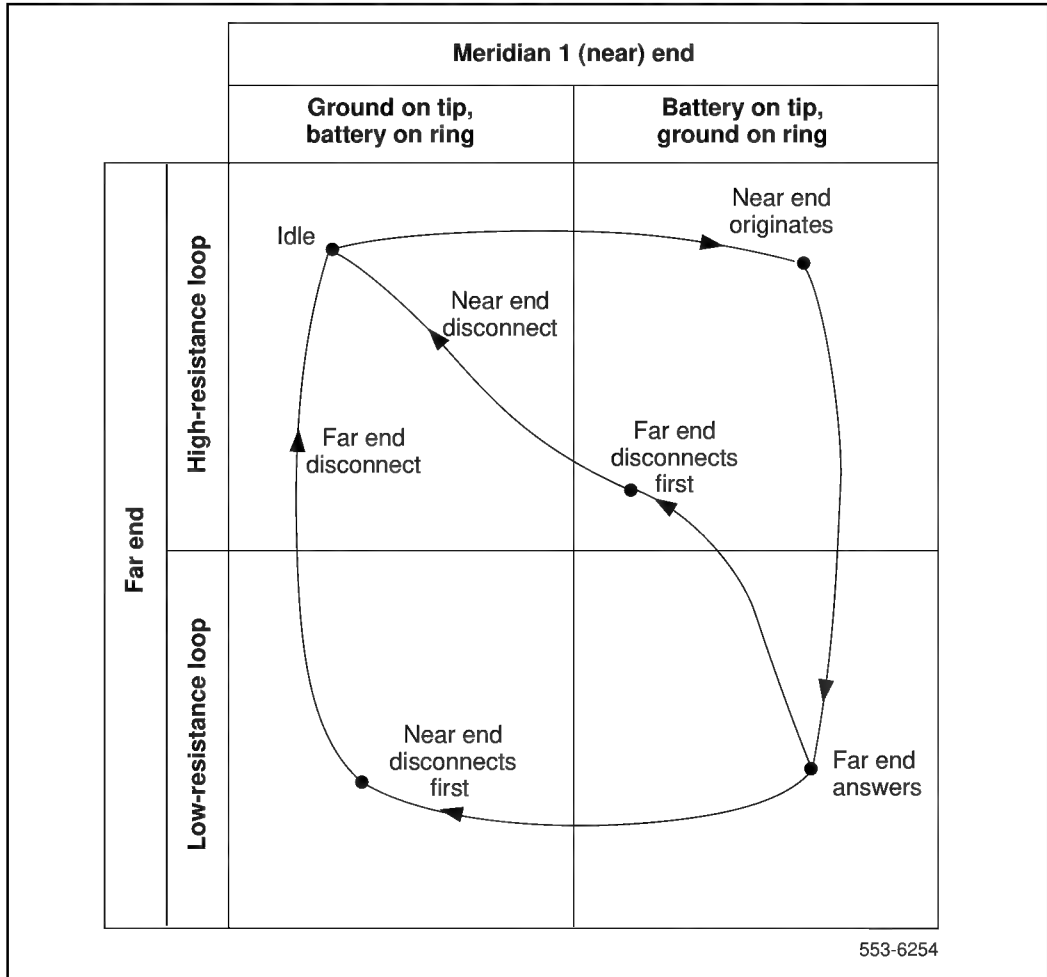
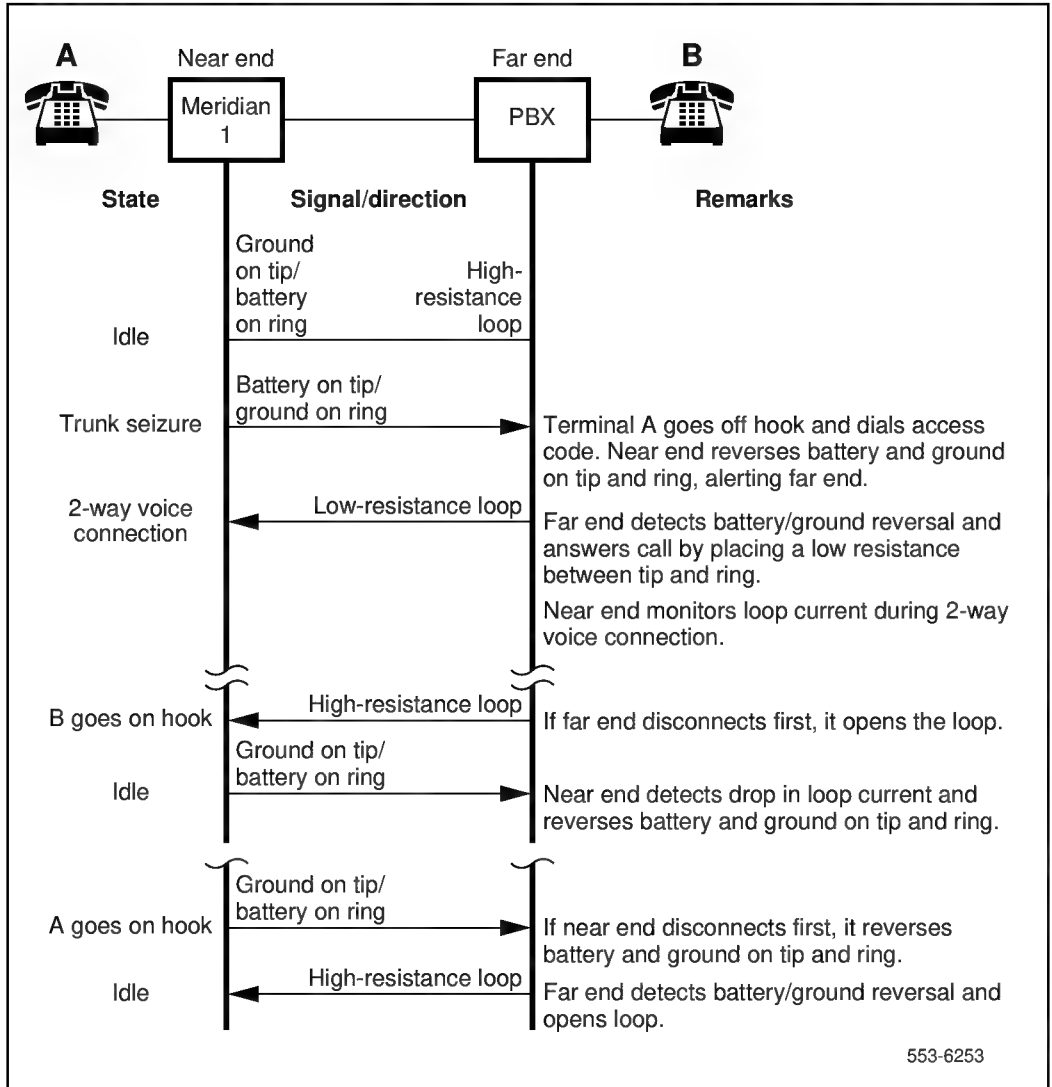


Figure 32**Two-way, loop OAID, tie trunk call connection sequence—outgoing call to far-end PBX**

Recorded announcement trunk operation

Note: Refer to “Multi-Channel RAN modes” on page 65 for information on Multi-Channel RAN modes, which are not linked to a RAN machine or a given trunk.

When configured for recorded announcement (RAN) operation, a trunk unit is connected to a customer-provided-recorded announcement machine. Announcement machines must be compatible with Meridian 1 RAN trunks and should be set up according to the manufacturer’s instructions.

Each trunk unit provides the following for operation with RAN equipment:

- pulse start, level start, or continuous operation modes
- selectable termination of tip and ring leads into 600 or 900 ohms for interface with a low-impedance (2- or 4-ohm) source
- connection of up to 24 trunk units to a single announcement machine channel

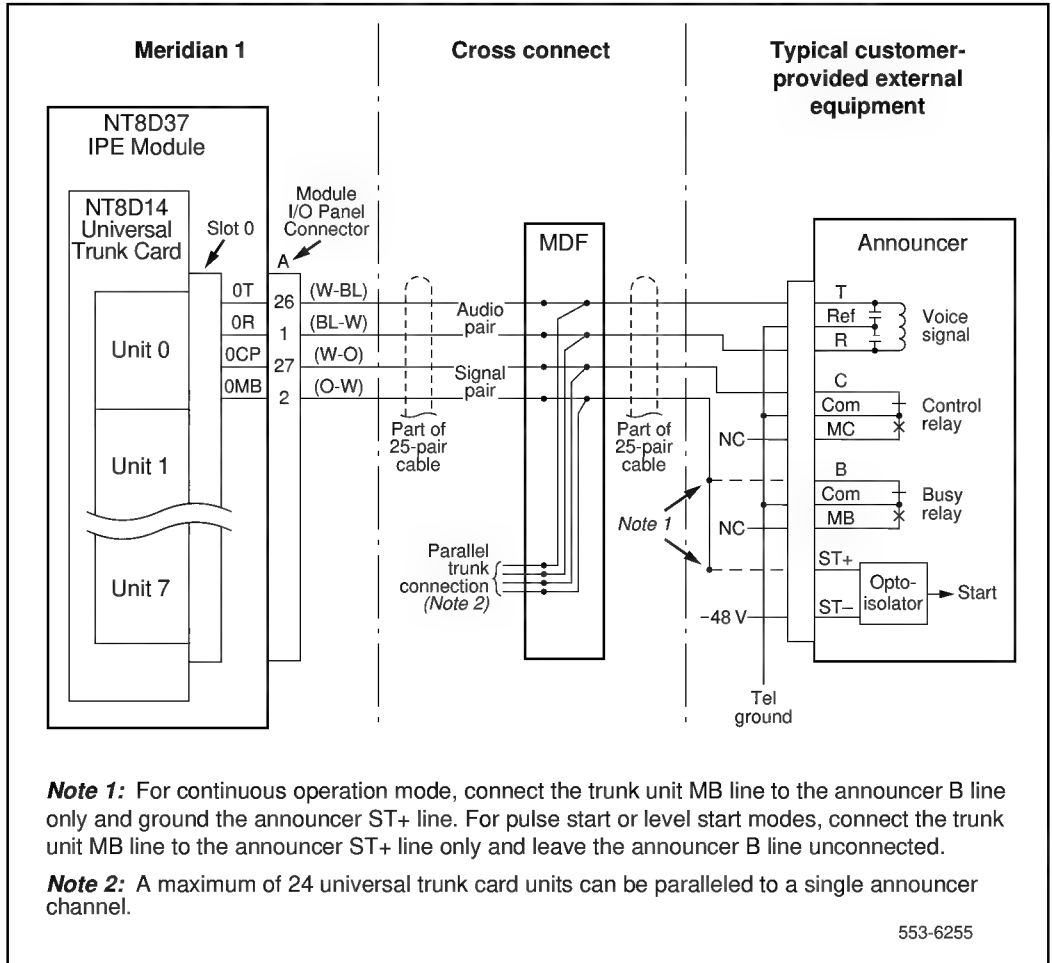
Recorded announcement machines

Recorded announcement machines store prerecorded voice messages that are played back to the trunk units to which they are connected. Most commercially available announcement machines store recordings digitally, although some drum and tape units are still in service.

An announcement machine may provide one or more channels and each channel may be prerecorded with a different message. Some announcement machines also provide a special information tone (SIT) capability. These tones are inserted at the beginning of intercept messages (such as “Your call cannot be completed as dialed. Please check the number and try again.”).

Figure 33 shows a typical connection from a single announcement machine channel to unit 0 on a universal trunk card installed in slot 0 in an NT8D37 IPE Module. See *Meridian 1 system installation procedures* (553-3001-210) for complete trunk wiring information.

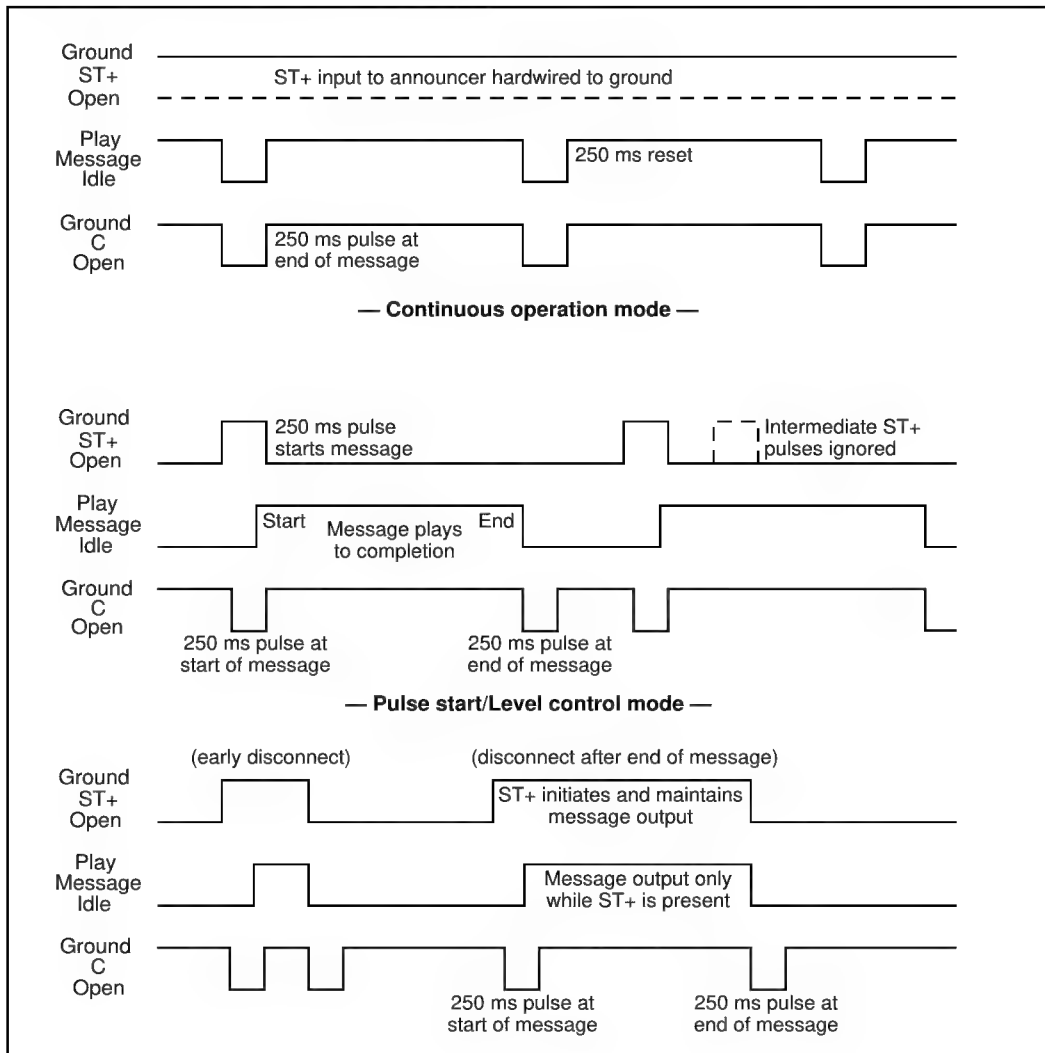
Figure 33
Connecting RAN equipment to the NT8D14 Universal Trunk Card (typical)



RAN modes of operation

Figure 34 shows the relationship of control signals to message playback for the operating modes available in announcement machines. The signal names shown in the figure are typical.

Figure 34
RAN control signals (Control GRD = IDLE)



Multi-Channel RAN modes

In Multi-Channel RAN, multiple RAN channels can be configured within one RAN trunk route. In a Multi-Channel RAN route, each trunk has its own dedicated RAN channel on a physical RAN machine. Multi-Channel RAN routes do not support the cross connecting (daisy chains) of multiple trunk ports together so that several callers hear the same RAN message.

The new multi-channel machine types - Continuous Mode Multi-Channel (MCON), Pulse Start/Stop Multi-Channel (MPUL) and Level Start/Stop Multi-Channel (MLVL) - are not linked to a RAN machine or a given trunk. All trunks belonging to the RAN route are considered independent. RAN trunks and RAN machine channels are connected one to one. Accordingly, if one RAN trunk is detected as faulty, then all other trunks are not impacted.

For these new RAN machine types, the maximum length of the recorded announcement is two hours. The meaning of a ground signal received from the RAN machine (play or idle) is configured in LD 16.

Multi-Channel Level Start/Control Mode (minimum vintage BA)

Introduced in X11 Release 21.41 and later software, a new RAN mode of operation is available called "Multi-Channel Level Start/Control Mode." This mode allows provisioning of multiple RAN channels for a RAN route (playing the same message independently on demand) cross-connected one-for-one to each RAN trunk in a multi-channel level start RAN route. RAN trunks should not be bridged in a multi-channel RAN route.

The Route Data Block overlay (LD 16) is used to configure a RAN route in Multi-Channel Level Start/Control mode, using the following response: (RTYP = MLSS).

Trunk members are provisioned in the Trunk Data Block (LD 14).

Refer to "Programming RAN trunks" on page 67 and to the *X11 input/output guide* for complete instructions on service change programs.

Continuous operation mode In the continuous operation mode (sometimes called the *Audichron* mode), a message is constantly played, over and over again. Callers “barge in” on a playing message or are provided with a ringback tone until the message begins its next playing. The start line (ST+) is hardwired to always be active (see [Figure 34](#)). At the end of each message, a pulse is issued on the “C” line that is used by the trunk unit to cut through to the waiting call.

Note: The “B” (busy) signal line shown in [Figure 33](#) (not represented in [Figure 34](#)) is used to indicate availability of an announcement machine message to the trunk unit when configured for the continuous operation mode. This signal is made active (ground) by the announcement machine if the channel contains a recorded message and is in an online condition. The “B” line is not connected to a trunk unit when configured for start mode operation.

Start modes (minimum vintage BA) In a start mode (sometimes called the *Code-a-Phone* or *start-stop* mode), playback of a message does not begin until a start pulse is received by the announcement machine. Two subcategories of the start mode exist: pulse start and level start.

In the pulse start mode, a start pulse activates playback of a message that continues until completion (see [Figure 34](#)). The announcement machine ignores all other start pulses that might occur until the message is complete.

In the level start mode, the start signal is a “level” rather than a pulse. The leading edge of the start signal initiates message playback that continues until either the trailing edge of the start signal occurs or the end of the message is reached. A message that is terminated by the trailing edge of a level start signal is immediately reset and again made available for playback.

Call routing to RAN trunks

Software programs in the Meridian 1 control recorded announcement machines. These programs detect the calls to be intercepted, determine the type of intercept treatment required (overflow, attendant, announcement, etc.), queue the intercept, and provide ringback tone to the calling party. At the proper time, an intercepted call is connected to the appropriate RAN trunk.

Programming RAN trunks

The type of intercept and the RAN trunk parameters are defined in the Trunk Administration (LD 14), Customer Data Block (LD 15), and Trunk Route Administration (LD 16) programs.

The Trunk Administration and Route Administration programs specify the RAN trunk, the type of announcement machine, the number of repetitions of announcements before a forced disconnect (all calls) or an attendant intercept is initiated (CCSA/DID calls only), and the point at which the trunk may be connected to the announcement.

The Customer Data Block program defines the type of intercept and the trunk route to which the intercept is to be connected.

Refer to the *X11 input/output guide* for complete instructions on service change programs.

Electrical specifications

[Table 4](#) gives the electrical characteristics of the universal trunk card.

Table 4
Universal trunk card—trunk interface electrical characteristics

Characteristic	CO/FX/WATS trunks	DID or tie trunks	RAN trunks	Paging trunks
Terminal impedance	600 or 900 ohms (Note 1)		600/900 ohms (Note 1)	600 ohms
Balance impedance	600 or 900 ohms (Note 1), 3COM, or 3CM2 (Note 2)		N/A	N/A
Supervision type	Ground or loop start (Note 3)	Loop start (with ans sup) (Note 3)	Continuous, level, or pulse	N/A
DC signaling loop length (max)	1700-ohm loop with near-end battery of -42.75 V	2450-ohm loop with near-end battery of -44 V	600/900-ohm loop	600 ohm loop
Far-end battery	-42 to -52.5 V (Note 4)	-42 to -52.5 V	-42 to -52 V	N/A
Minimum detected loop current	20 mA	10 mA	10 mA	N/A
Ground potential difference	±3 V		±1 V	±1 V
Low DC loop resistance during outpulsing	<300 ohms	N/A	N/A	N/A
High DC loop resistance	Ground start ≥ 30k ohms; loop start ≥ 5M ohms	N/A	N/A	N/A
Ring detection	17 to 33 Hz 40 to 120 V rms	N/A	N/A	N/A
Line leakage	≥ 30k ohms, tip-to-ring, tip-to-ground, ring-to-ground		N/A	N/A
AC induction rejection	10 V rms, tip-to-ring, tip-to-ground, ring-to-ground		N/A	N/A
Note 1: Selected in software.				
Note 2: Selected by jumper strap settings on card. Refer to Tables 8, 9, and 10 for details.				
Note 3: Loop start answer supervision introduced with vintage BA cards and release 19 software.				
Note 4: For loop extender application, the maximum voltage applied between tip and ring is -105 V ±5%. The minimum DC loop resistance for this type of application is 1800 ohms.				

Power requirements

Power to the universal trunk card is provided by the module power supply (AC or DC). [Table 5](#) lists the power requirements for the universal trunk card.

Table 5
Power requirements

Voltage	Tolerance	Current (max.)
+15.0 V dc	+5%	306 mA
−15.0 V dc	±5%	306 mA
+5.0 V dc	±5%	750 mA
+8.5 V dc	±2%	450 mA
−48.0 V dc	±5%	415 mA

Foreign and surge voltage protection

The universal trunk card meets UL-1489 and CS03 over-voltage (power cross) specifications and FCC Part 68 requirements.

Environmental specifications

[Table 6](#) lists the environmental specifications for the universal trunk card.

Table 6
Environmental specifications

Parameter	Specifications
Operating temperature	0° to +60° C (+32 to +140° F), ambient
Operating humidity	5 to 95% RH (noncondensing)
Storage temperature	−40° to +70° C (−40° to +158° F)

Connector pin assignments

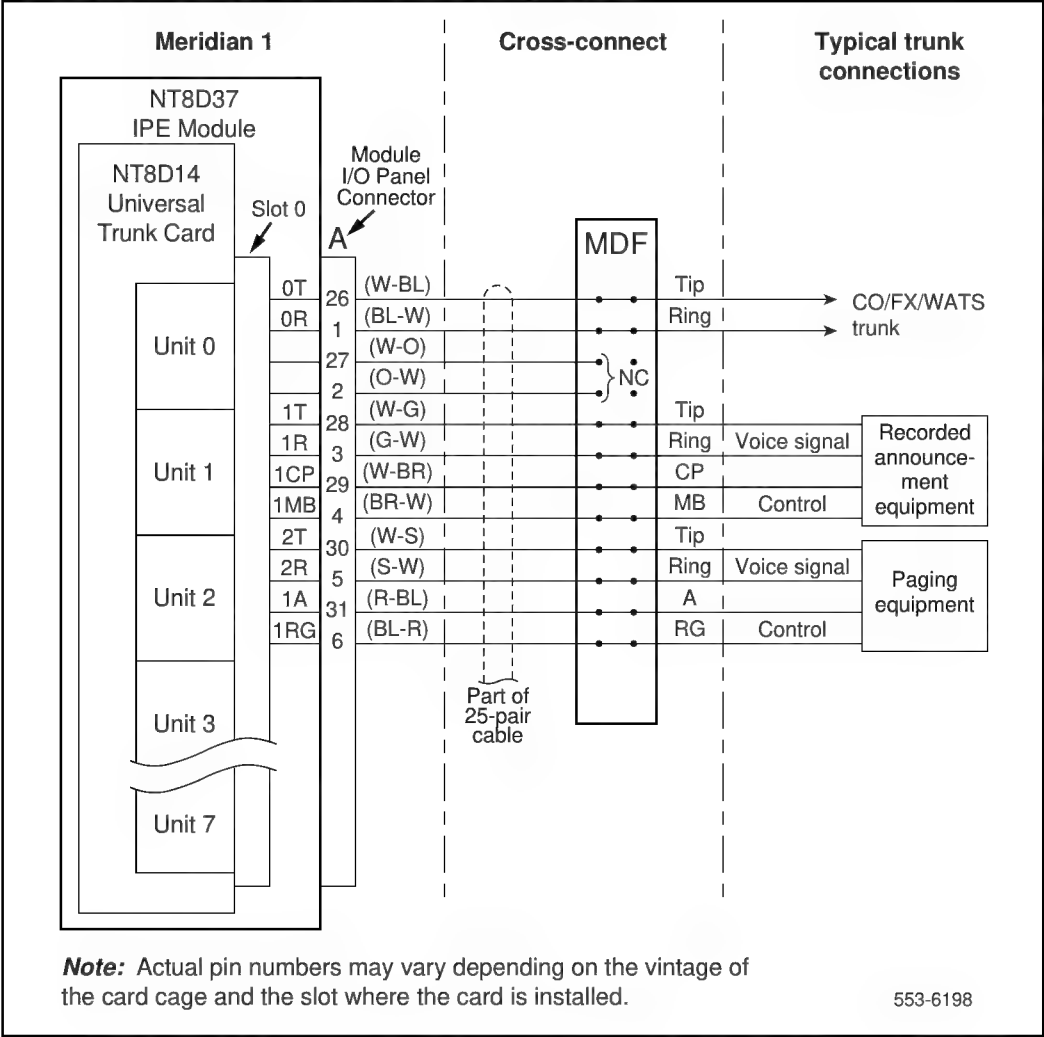
The universal trunk card brings the eight analog trunks to the IPE backplane through a 160-pin connector shroud. The backplane is cabled to the input/output (I/O) panel on the rear of the module, which is then connected to the main distribution frame (MDF) by 25-pair cables.

Telephone trunks connect to the universal trunk card at the MDF using a wiring plan similar to that used for line cards. A typical connection example is shown in [Figure 35](#), and a list of the connections to the universal trunk card is shown in [Table 7](#). See *Meridian 1 system installation procedures* (553-3001-210) for complete I/O panel connector information and wire assignments for each tip/ring pair.

Table 7
Universal trunk card—backplane pinouts

Trunk Number	Back-plane Pin	Signal			Back-plane Pin	Back-plane Pin	Signal		
		RAN mode	Paging mode	Other modes			RAN mode	Paging mode	Other modes
0	12A	Tip	Tip	Tip	12B	Ring	Ring	Ring	
	13A	CP	A	N/A	13B	MB	RG	N/A	
1	14A	Tip	Tip	Tip	14B	Ring	Ring	Ring	
	15A	CP	A	N/A	15B	MB	RG	N/A	
2	16A	Tip	Tip	Tip	16B	Ring	Ring	Ring	
	17A	CP	A	N/A	17B	MB	RG	N/A	
3	18A	Tip	Tip	Tip	18B	Ring	Ring	Ring	
	19A	CP	A	N/A	19B	MB	RG	N/A	
4	62A	Tip	Tip	Tip	62B	Ring	Ring	Ring	
	63A	CP	A	N/A	63B	MB	RG	N/A	
5	64A	Tip	Tip	Tip	64B	Ring	Ring	Ring	
	65A	CP	A	N/A	65B	MB	RG	N/A	
6	66A	Tip	Tip	Tip	66B	Ring	Ring	Ring	
	67A	CP	A	N/A	67B	MB	RG	N/A	
7	68A	Tip	Tip	Tip	68B	Ring	Ring	Ring	
	69A	CP	A	N/A	69B	MB	RG	N/A	

Figure 35
Universal trunk card—typical cross connect example



Configuration

The trunk type for each unit on the card as well as its terminating impedance and balance network configuration is selected by software service change entries at the system terminal and by jumper strap settings on the card.

NT8D14BB (Rel 10 and higher) has a reduced jumper strap setting on the card. There are only three jumpers, J1.X, J2.X, and J3.X per channel.

[Tables 8, 9, and 10](#) show the functionality of these 3 jumpers.

Jumper strap settings

For most applications, the jumper strap settings remain set to the standard configuration as shipped from the factory (see [Table 8](#)).

For CO/FX/WATS or tie trunk loops exceeding 1524 meters (5000 ft.), DID trunks exceeding a loop resistance of 600 ohms, or RAN trunks operating in pulse start or level start modes, the jumper strap settings must be changed as shown in [Table 9](#). [Figure 37](#) shows jumper locations on the universal trunk card (vintage BA).

Note: Refer to *Circuit card installation and testing* (553-3001-211) for vintage AA jumper strap settings.

Service change entries

The trunk type, terminating impedance, and balance network are selected by making service change entries in the Trunk Administration program (LD 14). Refer to [Table 10](#) to select the proper values for the trunk type and loop length being employed. Refer to the Meridian 1 *X11 input/output guide* for LD 14 service change instructions.

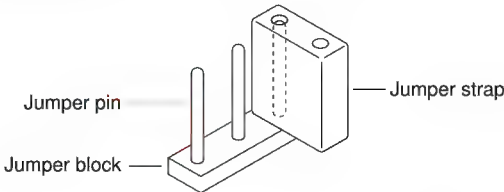
Before the appropriate balance network can be selected, the loop length between the near end (Meridian 1) and the far end (a central office, for example) must be known. To assist in determining loop length, some typical resistance and loss values for the most common cable lengths are given in [Table 11](#) for comparison with values obtained from actual measurements.

Table 8
Jumper strap settings—factory standard (NT8D14BA, NT8D14BB)

Trunk types	Loop length	Jumper strap settings (Note 1)			
		J1.X	J2.X	J3.X	J4.X (Note 2)
CO/FX/WATS	0–1524 m (5000 ft.)	Off	Off	1–2	1–2
2-way tie (LDR)					
2-way tie (OAID)					
DID	0–600 ohms	Off	Off	1–2	1–2
RAN: continuous operation mode	Not applicable: RAN and paging trunks should not leave the building.	Off	Off	1–2	1–2
Paging					

Note 1: Jumper strap settings J1.X, J2.X, J3.X, and J4.X apply to all eight units; “X” indicates the unit number, 0–7. “Off” indicates that no jumper strap is installed on a jumper block. Store unused straps on the universal trunk card by installing them on a single jumper pin as shown below.

Note 2: For the NT8D14BB (Release 10 and higher) card, J4.X is not provided on the card. The J4.X jumper setting specified in [Table 8](#) does not apply.



The diagram illustrates the installation of a jumper strap. It shows a rectangular 'Jumper block' with two vertical 'Jumper pins'. A 'Jumper strap' is shown as a small rectangular component with a loop that is being inserted onto one of the pins. Labels with leader lines identify the 'Jumper pin', 'Jumper block', and 'Jumper strap'.

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Table 9

Jumper strap settings—extended range (NT8D14BA, NT8D14BB, NT8D14BB Release 10 and up)

Trunk types	Loop length	Jumper strap settings (Note 1)			
		J1.X	J2.X	J3.X	J4.X (Note 2)
CO/FX/WATS	> 1524 m (5000 ft)	Off	Off	1–2	2–3
2-way tie (LDR)					
2-way tie (OAID)					
DID	> 600 ohms	On	On	1–2	2–3
RAN: pulse start or level start modes	Not applicable: RAN trunks should not leave the building.	Off	Off	2–3	1–2
Note 1: Jumper strap settings J1.X, J2.X, J3.X, and J4.X apply to all eight units; “X” indicates the unit number, 0–7. “Off” indicates that no jumper strap is installed on a jumper block. Note 2: For the NT8D14BB Release 10 or later card, J4.X is not provided on the board. The J4.X jumper setting specified in Table 9 does not apply.					

Figure 36
Universal trunk card—jumper locations (for NT8D14BB release 10 and higher)

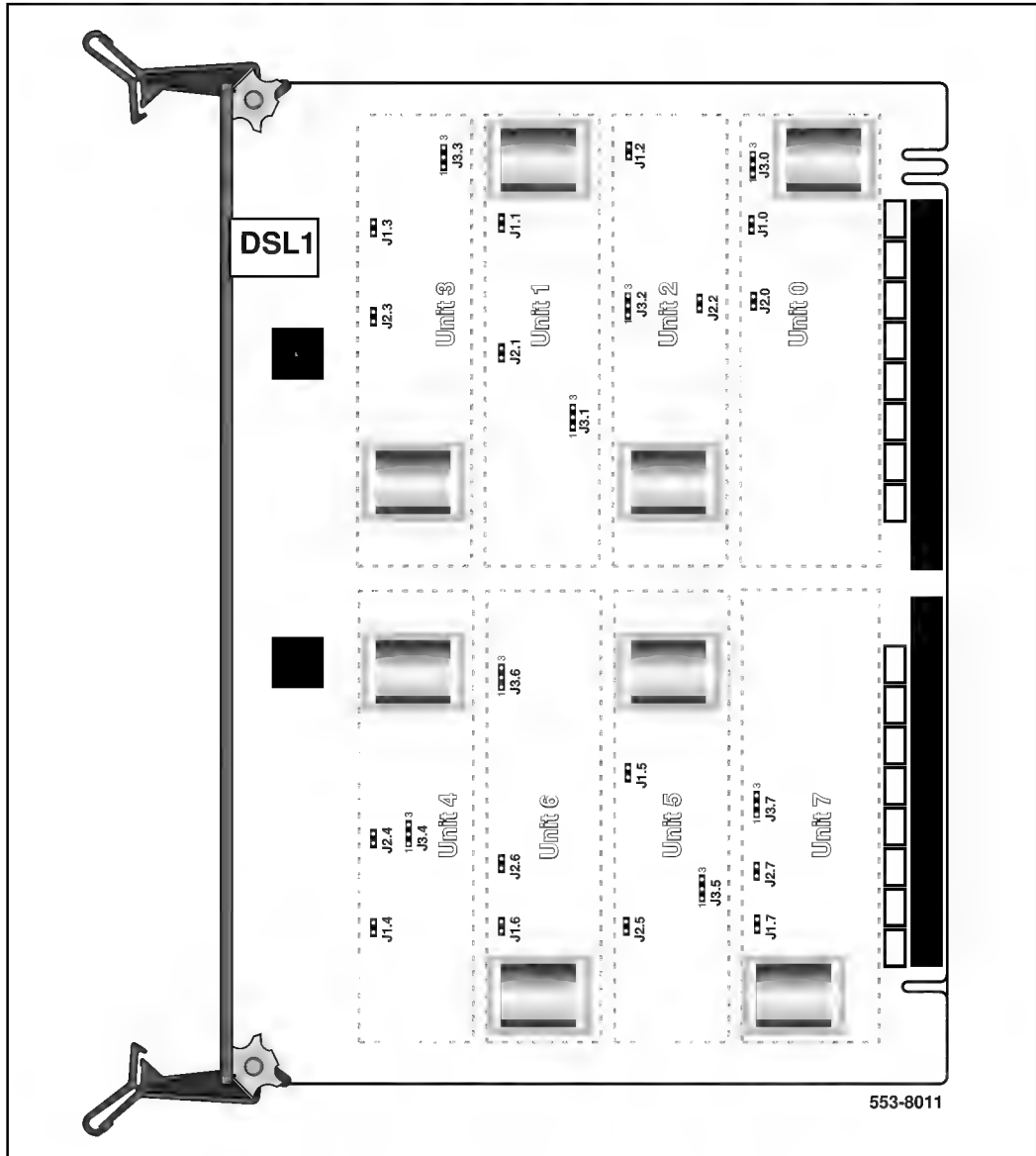


Figure 37

Universal trunk card—jumper locations (for NT8D14BA, NT8D14BB release 9 and below)

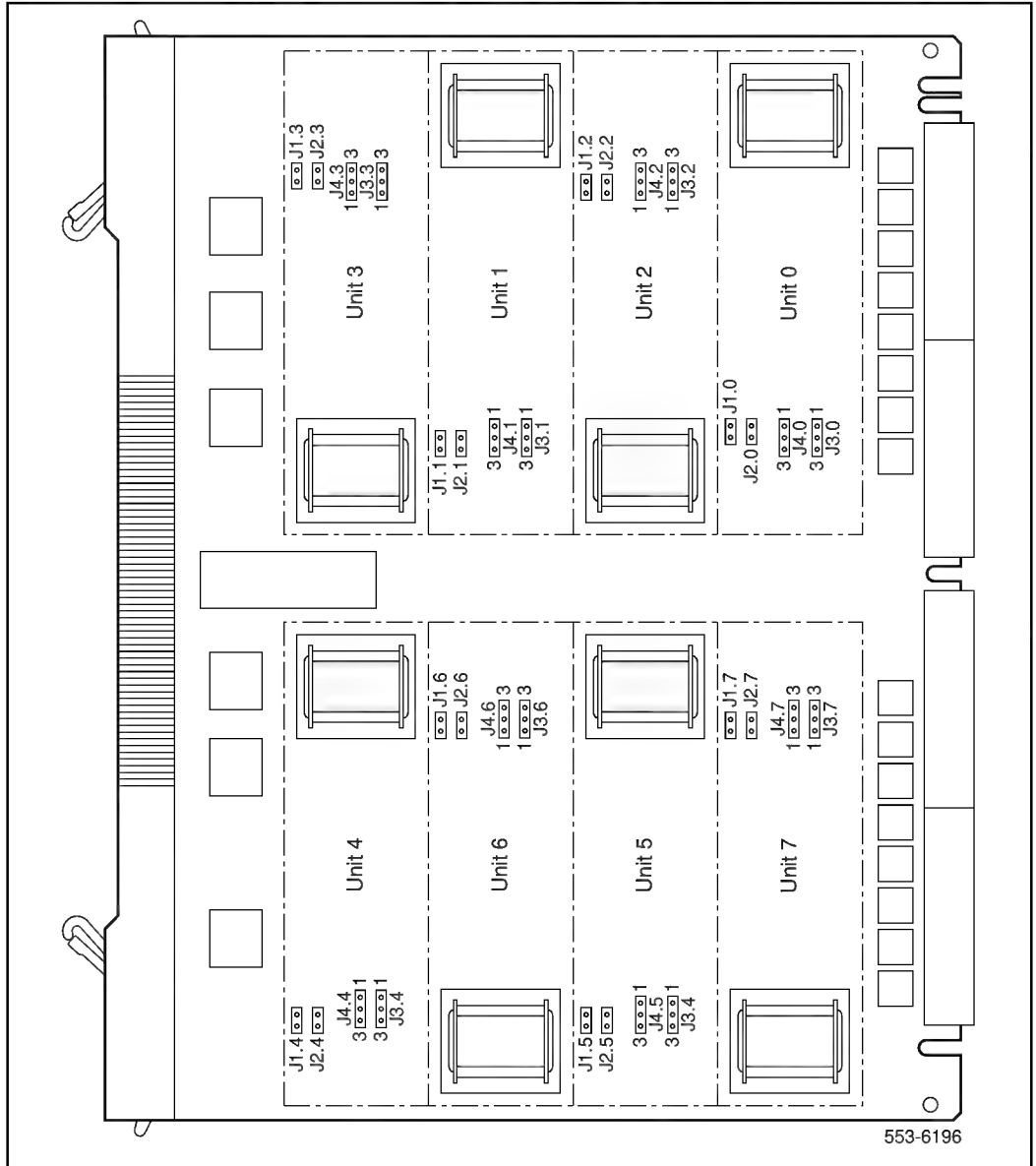


Table 10
Trunk types—termination impedance and balance network (NT8D14BA, NT8D14BB)

Trunk types	Terminating impedance (Note 1)	Balance network for loop lengths (Note 2)		
		0–915 m (0–3000 ft)	915–1524 m (3000–5000 ft)	> 1524 m (> 5000 ft)
CO/FX/WATS	600 or 900 ohms	600 ohms	3COM	3CM2
2-way tie (LDR)	600 or 900 ohms	600 ohms	3COM	3CM2
2-way tie (OAID)	600 or 900 ohms	600 ohms	3COM	3CM2
DID (loop length < 600 ohms)	600 or 900 ohms	600 ohms	3COM	3CM2
DID (loop length ≥ 600 ohms)	600 or 900 ohms	600 ohms	N/A	3CM2
RAN: continuous operation mode	600 or 900 ohms	600 or 900 ohms	N/A	N/A
Paging	600 ohms	600 ohms	N/A	N/A

Note 1: The terminating impedance of each trunk unit is software selectable in LD 14 and should match the nominal impedance of the connecting equipment.

Note 2: The balance network of each trunk unit is software selectable between resistive 600 or 900 ohms or 3COM and jumper selectable between 3COM and 3CM2. Jumper selection for 3COM/3CM2 restriction does not apply to NT8D14BB (Release 10 and later).

Table 11
Cable loop resistance and loss

Cable length	Cable loop resistance (ohms)			Cable loop loss (dB) (nonloaded at 1kHz)		
	22 AWG	24 AWG	26 AWG	22 AWG	24 AWG	26 AWG
915 m (3000 ft)	97	155	251	0.9	1.2	1.5
1524 m (5000 ft)	162	260	417	1.6	2.0	2.5
2225 m (7300 ft)	236	378	609	2.3	3.0	3.7
3566 m (11700 ft)	379	607	977	3.7	4.8	6.0
5639 m (18500 ft)	600	960	1544	5.9	7.6	9.4

Port-to-port loss configuration

Loss parameters are selected on the Universal trunk card by a switchable pad controlled by codec emulation software. For convenience in this discussion, the pads settings are called “in” and “out.” Pad settings are determined by the two factors listed below: the first is under direct user control; the second is controlled indirectly.

- Class of service is assigned in LD 14
- Port-to-port connection loss is automatically set by software on the basis of the port type selected in LD 16; only the port type is set by the user.

The transmission properties of each trunk are characterized by the class of service assigned in LD 14. Transmission properties can be via net loss (VNL) or not via net loss (non VNL).

The VNL class of service is assigned at the prompt CLS with the response VNL. The non-VNL class of service is assigned at prompt CLS by selecting either the TRC (transmission compensated) or NTC (non-transmission compensated) response.

Non-VNL trunks are assigned a TRC or NTC class of service to ensure stability and minimize echo when connecting to long-haul trunks, such as tie trunks. The class of service determines the operation of the switchable pads contained in each unit. They are assigned as follows:

- TRC for a 2-wire non-VNL trunk facility with a loss of greater than 2 dB, or for which impedance compensation is provided, or for a 4-wire non-VNL facility
- NTC for a 2-wire, non-VNL trunk facility with a loss of less than 2 dB, or when impedance compensation is not provided

See [Table 12](#) for the pad switching control for the various through connections and the actual port-to-port loss introduced for connections between the Universal trunk card and any other IPE or PE port designated as Port B.

Table 12
Pad switching algorithm

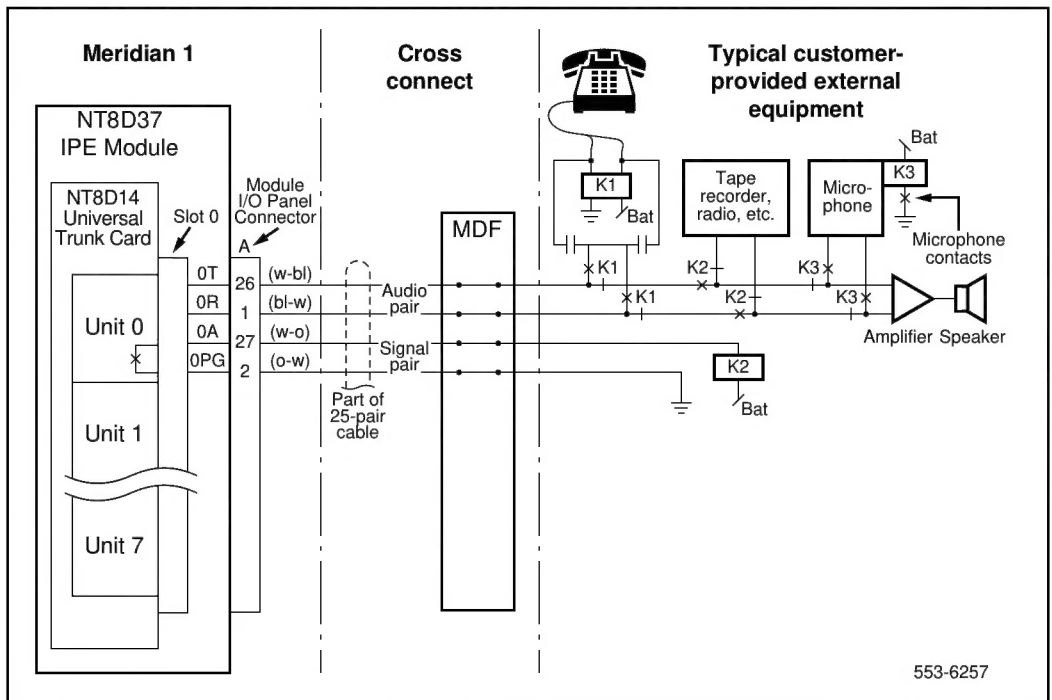
Port B	Port B pads		Universal Trunk Pads		Port-to-port loss (dB)	
	Transmit D to A	Receive A to D	Transmit D to A	Receive A to D	Port B to Universal trunk card	Universal trunk card to Port B
IPE line	N/A	N/A	Out	Out	0.5	0.5
Universal trunk (TRC)	In	Out	In	Out	1	1
IPE tie (VNL)	In	In	Out	Out	0	0
PE line	N/A	N/A	Out	Out	1	1
PE CO/FX/WATS (TRC)	Out	Out	In	In	1	1
PE tie	Out	Out	In	In	0.5	0.5
Note 1: Transmit and receive designations are from and to the Meridian 1. Transmit is from the Meridian 1 to the external facility (digital-to-analog direction in the Universal trunk card). Receive is to the Meridian 1 from the external facility (analog-to-digital direction in the Universal Note 2: When Port B is the call originating port. If the Universal trunk card is the originating port, the UTC pads are out, the Port B (PE CO/FX/WATS) pads are in.						

Applications

Paging trunk operation

A universal trunk card unit can be configured as a paging trunk. Configure units as paging trunks in the Trunk Administration program (LD 14) and assign routes in the Route Administration program (LD 16). [Figure 38](#) shows a typical connection from customer-provided equipment to unit 0 on a universal trunk card that is installed in slot 0 in an NT8D37 IPE Module. See *Meridian 1 system installation procedures* (553-3001-210) for complete trunk wiring information.

Figure 38
Connecting paging equipment to the NT8D14 Universal Trunk Card (typical)



Music operation

A trunk unit can be connected to a music source. The audio source should provide an adjustable power output at 600 ohms. Configure units for music at the MUS or AWR prompts in the Trunk Administration program (LD 14) and assign routes at the MRT prompt in the Trunk Route Administration program (LD 16).

Music operation is similar to that of RAN in the continuous operation mode. Connect the unit tip and ring leads to the audio source and ground the CP line at the MDF (see [Figure 33](#)). If the music source is equipped with contacts that close when music is online, use these contacts to provide a ground to the MB line; otherwise, ground the MB line at the MDF.